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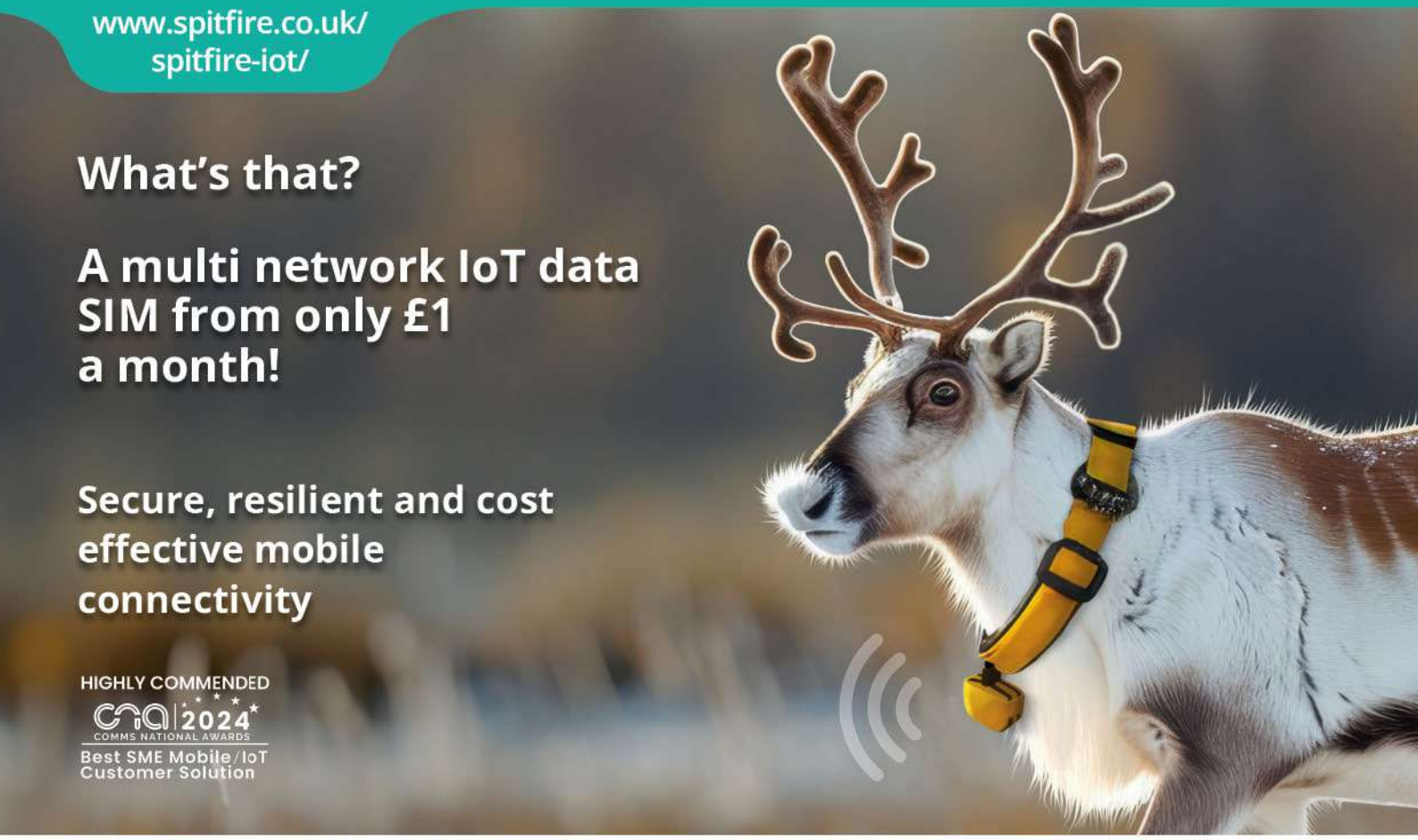

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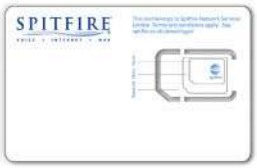

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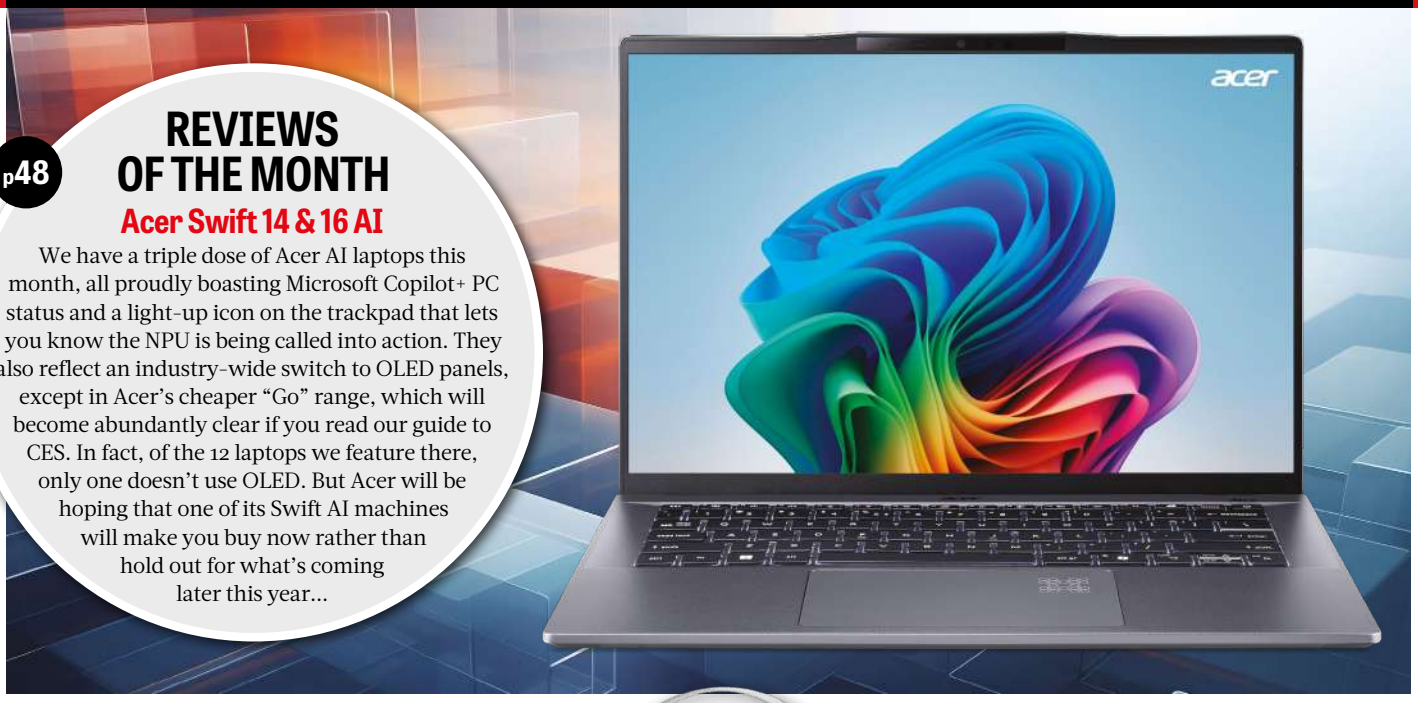

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Acer Swift 14 & 16 AI

We have a triple dose of Acer AI laptops this month, all proudly boasting Microsoft Copilot+ PC status and a light-up icon on the trackpad that lets you know the NPU is being called into action. They also reflect an industry-wide switch to OLED panels, except in Acer's cheaper "Go" range, which will become abundantly clear if you read our guide to CES. In fact, of the 12 laptops we feature there, only one doesn't use OLED. But Acer will be hoping that one of its Swift AI machines will make you buy now rather than hold out for what's coming later this year...

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We love CES for its smorgasbord of new technology, but pulling together this 13-page feature summarising the best of the show was almost as exhausting as attending it for a week.

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If you find your daily life constantly interrupted by pop-ups and chirrups from your computer and mobile devices, read our feature on how to live a quieter existence.

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Piers Daniell

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You can protect yourself from malware perfectly well for free thanks to Microsoft Defender and alternatives, but as our group test of 12 contenders reveals there are good reasons to consider a paid-for security suite.

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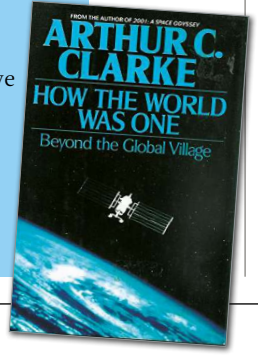

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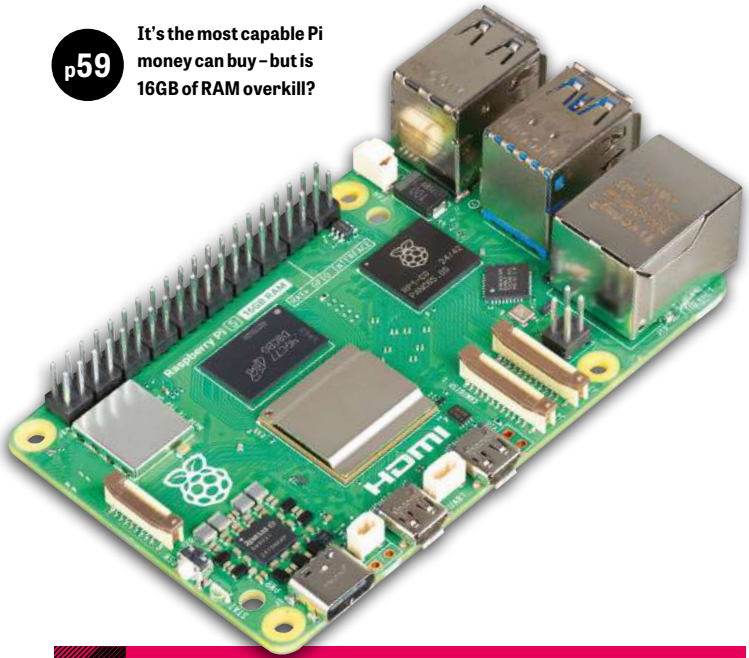

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BEST SECURITY SUITES VS BEST FREE ANTIVIRUS

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It's time for the world's biggest tech companies to take responsibility

One of the reasons I love going to CES each year is that I get to interview people I otherwise simply wouldn't meet. Some are high-flying execs at international companies, and that's great. After speaking to a trio of Intel VPs in one particularly intense half-hour session, I feel I have a far better insight into what's happening at the company and how that will affect what it's doing this year. In short, pedal to the metal for the core skills of making, well, cores, but a shedding of distractions such as its RealSense camera division.

But I also enjoy speaking to the up-and-comers. We highlight a couple in our big CES feature, starting on p26, such as a Japanese PhD student who has created a hardware platform for third parties to develop their own robots. Or consider the Dutch startup LV Energy (**lvenergy.io**) – which didn't even make our roundup of 56 products – which is converting the kinetic energy trapped in sound waves into electricity, so that noise pollution can actually be turned into something useful.

CES is also a sampling point in time, giving us an idea of where technology is. If last year was about the hype and hope of AI, seeing the term slapped onto everything from binoculars to rabbits (well, the Rabbit r1), this year it has matured. But only a little: 2024 was equivalent to toddler tantrums, with many noisy outbursts, while this year you can have a conversation about what it wants to be when it grows up.

Still, there is the equivalent of a shrug of the shoulders from the PC-making industry. The equivalent of we'll see what happens, not up to me, whatevs. And to be clear, I'm not blaming the kids of Acer, Dell, HP and Lenovo: I blame the grown-ups, by which I mean AMD, Intel and Microsoft. These are the three companies that should have been setting clear guidelines as to what AI means when it comes to computers, and they messed up.

I'm willing to cut AMD some slack, since at least it branded its NPU as Ryzen AI from the start. And you know whether its latest ranges of CPUs have a powerful NPU inside because they include "AI" in the name. Intel, on the other hand, gains a hard Paddington stare, because you have to delve into the specifications of each range – sometimes each processor within the range – to find out whether it includes an NPU with enough TOPS to qualify for Microsoft's Copilot+ PC branding.

Then we come to Microsoft itself, which has horribly confused the situation by delaying certification of Copilot+ PCs, to the point where one senior VP, at a company I won't name, simply shook his head in despair when I spoke to him about it. Not to mention the confusion of Copilot+ PC branding itself: how is the average punter meant to know the difference between Copilot the cloud-based service and Copilot+ PCs? Especially when Microsoft dollies the term "Copilot" onto so many other services it's rendered almost meaningless.

I would have spoken to Microsoft about this, and could perhaps have shared its defence in this column, had it attended the world's biggest tech show. But for several years now Microsoft has deemed itself too important to show up. Well, Microsoft, if Intel is willing to stand up to scrutiny after its annus horribilis then I suggest it's time for you to pull on the long trousers and do the same.

Tim Danton
Editor-in-chief

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KG Orphanides
When it comes to rating security suites – from AV effectiveness to the quality of bundled VPNs – nobody does it better than KG Orphanides. Read their verdict from p78.

Rois Ni Thuama
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Davey Winder
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Want to live in the future today? You can indeed travel in a driverless car, work in the metaverse and enjoy robot service in your home. Just don't expect miracles. See p126.

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What's a deal-breaker for you when choosing new technology?

"I always check the warranty and the customer service. So, what's covered, how does the company do in the *PC Pro* Excellence Awards and other surveys – and do they actually offer proper support at all? I'm clearly a pessimist as I assume something will go wrong."

"Anything that ONLY works with a subscription or cloud service – I'm out. I've seen far too many services come and go!"

"Vendor lock-in. As a Mac and iPad owner, it would make far more sense for me to use an iPhone than Android. But I don't like the idea of relying on one company for practically everything."

"In-app purchases that don't last at least until the next full version release. Perpetual licences seem to be an endangered species."

"Ironically, the usual breaker is whether the product is new. If you look in the right places, there's normally a decent refurb with a bargain price. 'Not-new' isn't always possible (or practical) but increasingly with day-to-day tech, it really is."

"An app that's critical to the hardware that won't be supported in 18 months."

"Restrict me to a single company for ink refills, phone rechargers or widgets, then I'm not buying. I want a product, not a lifelong commitment."

"I'll ask for help with something – even if I have to make it up – during a trial and if the support is slow/non-existent or unhelpful then I dump it."

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Briefing

Background and analysis on all the important news stories

WordPress the nuclear button

CEO's aggressive behaviour is shaking confidence in the web publishing giant

Picking a fight with one of the leading WordPress-hosting companies by describing it as "a cancer"; twice telling staff who disagreed with him to pack their bags and take a pay-off; threatening to effectively down tools on the development of WordPress itself. It's been a tumultuous few months for the co-founder of WordPress, Matt Mullenweg, and it doesn't seem to be getting any calmer.

Mullenweg's dictatorial behaviour as the figurehead of WordPress is shaking confidence in his company, Automattic, and the future of the web publishing platform itself. Website owners are considering switching platforms, disgruntled staff are demanding a change of leadership, and there are rumours of a fork of WordPress, potentially creating a damaging split in the platform's user base.

What on earth is happening to WordPress?

Mullenweg's mission

The turmoil at WordPress kicked off in mid-September, when Mullenweg posted a blog attacking WP Engine, one of the biggest WordPress hosts in the business. Mullenweg accused the host of passing itself off as WordPress, claiming even his own mother was confused. Among other allegations, he also lambasted how little WP Engine contributed to the open-source WordPress, compared to his own WordPress host, Automattic.

"They do about half a billion in revenue on top of WordPress and contribute back 40 hours a week, Automattic is a similar size and contributes back 3,915 hours a week," he complained.

"This is one of the many reasons they are a cancer to WordPress, and it's important to remember that unchecked, cancer will spread," Mullenweg added.

> "Website owners are considering switching platforms, and disgruntled staff are demanding a change of leadership"

Shots fired, and with lawsuits flying back and forth, Mullenweg stepped up his campaign against WP Engine. He banned the company from accessing vital resources on WordPress.org, breaking many websites for WP Engine customers and leaving them exposed to security attacks. Developers logging into WordPress.org were also forced to tick a box declaring "I am not affiliated with WP Engine in any way, financially or otherwise" before they could get access. A court eventually forced Mullenweg to back down on both these measures.

LEFT **WordPress co-founder Matt Mullenweg is not afraid of controversy**

But Mullenweg wasn't just waging war with WP Engine, he went into battle with his own staff. In October, 159 Automattic staff – or 8.4% of the company's headcount – decided to accept Mullenweg's "alignment offer". If you disagreed with his stance on WP Engine you could take $30,000 or six months' salary, whichever was higher, and clear your desk. The offer was repeated a week later, except this time it was nine months' salary on offer. It's not clear how many walked the second time.

In January, Thijs Buijs from the company's Sustainability Team posted his resignation on the firm's internal Slack channel, after Mullenweg published a provocative Reddit post on Christmas Eve titled "What drama should I create in 2025?", which Buijs told colleagues was "yet another proof to me that this community needs a change of leadership".

Mullenweg replied to Buijs' Slack post with: "Today I learned that we have a sustainability team", before announcing that the entire team would be "dissolved".

Picking on the plotters

If the Christmas break that Mullenweg effectively enforced on his staff and the wider WordPress community, by shutting down many of WordPress.org's operations over the holidays, gave him time to take a break and calm down, it seemingly didn't work.

He came back all-guns blazing, picking fights with perceived plotters and announcing in January that Automattic would reduce its contribution to WordPress to match WP Engine's 45 hours per week.

"We've made the decision to reallocate resources due to the lawsuits from WP Engine," a post on the Automattic company news site stated. "This legal action diverts significant time and energy that could otherwise be directed toward supporting WordPress's growth and health."

Meanwhile, Mullenweg was back on the attack, with a blog post dripping in sarcasm, claiming that Joost de Valk – founder of SEO service Yoast – and others were plotting to create a WordPress fork. "To make this easy and hopefully give this project the push it needs to get off the ground, I'm deactivating the .org accounts of Joost, Karim, Se Reed, Heather Burns, and Morten Rand-Hendriksen," Mullenweg wrote.

To be fair to Mullenweg, de Valk had more than hinted at a breakaway, tweeting that he was "ready to lead the next releases" of WordPress and writing lengthy blogs on the future of the community. "I'm here, and willing to lead through this transition," he wrote on his blog. "Let me be clear though: we should not replace one BDFL [benevolent dictator for life] with another. This is a moment of transition. I'm also very willing to work with other leadership if it turns out the community wants someone else."

Others, however, were bemused as to why they should be on Mullenweg's blacklist, such as the self-described "tech policy wonk" Heather Burns, who posted on her own blog that she was nothing to do with any breakaway effort. She said she hadn't even logged into her WordPress account "since February 2020 – almost a full five years ago – which was when I retired from WP and all open-source involvement, specifically because of the primary and secondary harassment that he [Mullenweg] threw onto me".

Automattic declined to comment on these allegations.

Community in doubt

The aggressive and unpredictable behaviour of Mullenweg has left some website owners considering whether to stick with WordPress, still by far the most used CMS for website builders.

"Many non-profits worldwide rely on WordPress to connect with communities, raise funds, and create positive change," wrote one IT manager in an open letter to Mullenweg on Reddit. "However, instability in WordPress' ecosystem threatens their ability to do this."

> "As a business owner, I've been shocked by your behaviour and it has shaken my faith in the platform"

Another customer, replying to Mullenweg's Christmas Eve post, wrote: "As a business owner of 17 years who switched to WordPress + WooCommerce in 2016, I've been shocked by your behaviour and it has shaken my faith in the platform," adding "your recent actions have made me seriously consider whether another platform would be better, despite our heavy investment in your ecosystem."

And while there are some that have sympathy with Mullenweg and criticise WP Engine for profiting handsomely from WordPress without giving much back, open-source experts say Mullenweg has no cause for complaint. "That's the deal," blogged David Heinemeier Hansson, creator of web app framework Ruby on the Rails. "That's open source. I give you a gift of code, you accept the terms of the licence. There cannot be a second set of shadow obligations that might suddenly apply, if you strike it rich using the software."

Microsoft: let them eat AI

Microsoft 365 price bumped to accommodate Copilot

SET MENU
Starters
A delicious tray of entrees, with vegetarian options available
Fish course
A Dover Sole served on the bone, with smashed roast potatoes and green beans
Vegetarian course
A cauliflower steak with paprika dressing
Copilot

Microsoft has bundled its Copilot AI into Personal and Family editions of its Microsoft 365 apps – but it's bumping up subscription prices as a result.

Microsoft was previously charging a hefty £19 a month to add the AI extras to the former Office suite, but it's now decided to roll them in, albeit with limits. Personal and Family subscribers get 60 AI credits per month, with each prompt in apps such as Word, PowerPoint or Outlook consuming a single credit. Customers who want unlimited access to the AI can still pay £19 per month for Microsoft Copilot Pro.

Microsoft has used the bundling of the AI features and the inclusion of Designer (think Canva or Adobe Express) to justify the increase. In the UK, the monthly price of Microsoft 365 Family has risen from £7.99 to £10.49 (inc VAT), an increase of 31%. The Personal plan (with only a single licence) now costs £8.49 per month, though there are discounts on these prices if you commit to an annual subscription (£105 and £85 per year respectively).

Microsoft said it was upping the price for the first time since it first started selling Office apps on subscription 12 years ago. However, UK buyers are better off not buying a subscription from Microsoft at all. For instance, at the time of writing, you could get a 15-month Microsoft 365 Family subscription, bundled with McAfee antivirus, for £105 on Amazon – the same price you'd pay Microsoft for only a year. Or head to the *PC Pro* store (store.pcpro.co.uk), where you can pick up a 12-month Family subscription for £59.99.

Those with existing subscriptions are also getting the AI features, whether they asked for them or not. However, Microsoft will allow existing subscribers to effectively opt out of the AI, by switching to "Basic" or "Classic" plans that don't include the Copilot credits "for a limited time".

Ofcom's inflation ban backfires

Regulator's new rules could lead to higher broadband bills for consumers

Ofcom's decision to ban broadband providers from imposing inflation-linked price rises could lead to customers on cheaper tariffs facing the steepest price rises.

The telecoms regulator decided to ban mid-contract price hikes that are linked to inflation following the spike in 2022, which saw the UK's inflation rate rise to almost 10%. That left millions of customers facing huge price rises without any option to cancel their contract.

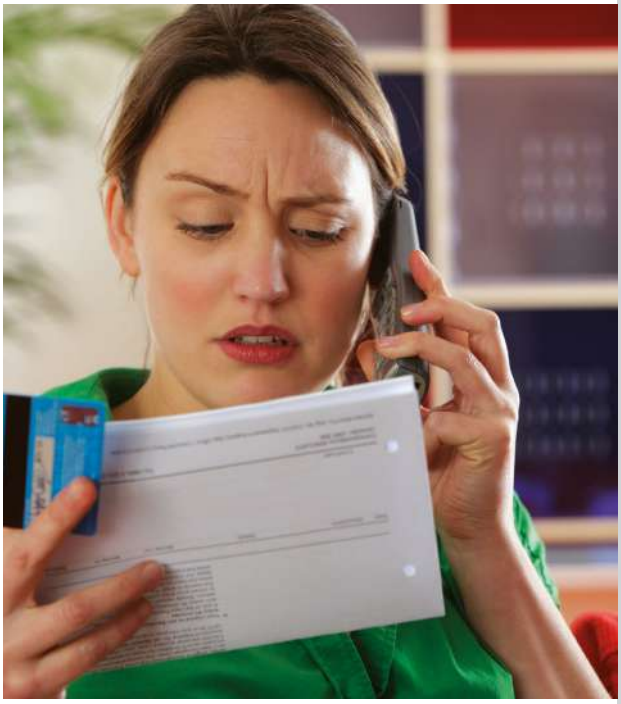
Ofcom's new rules ban inflation-linked price rises, stating that "telecoms providers must now set out up front, in pounds and pence, any price rises that will apply to customer contracts".

However, this has already led to some customers paying more than they would have under the previous system. BT, for example, has announced that broadband customers signing new contracts will face a fixed price increase of £3 per month. However, customers currently under contract, who are still being charged under the old system, would face price increases of 6.4% (inflation of 2.5% plus an additional 3.9% increase).

As a consequence, any customer on a broadband tariff costing less than £46.88 per month will end up paying more under the new pound-and-pence system than they would under the inflation-linked rises.

If other broadband providers follow suit and impose fixed price rises across the board, it will mean that those on the cheapest tariffs will be relatively worse off. For example, a BT customer paying £25 per month would have faced a £1.60 per month price increase under the old system, whereas the new flat increase is £3.

The TV presenter and founder of MoneySavingExpert.com, Martin Lewis, wrote to then chancellor Jeremy Hunt last year arguing that mid-contract price rises should be banned. "You have spent the past year focused on reducing inflation," he wrote. "Yet the policies of telecoms providers are both inflationary and anti-competitive. They bake into their contracts 3% or 4% above-inflation price hikes each year, which is, by definition, inflationary in its own right."



ABOVE Broadband customers might be in for a nasty shock

Lewis noted that Ofcom was consulting on the pound-and-pence system, adding that would still allow for above-inflation price rises, as we've now seen from BT. Lewis argued that if rises were to be allowed, it should have "an override saying it cannot be more than inflation".

An Ofcom spokesperson defended the decision to ban inflation-linked rises, arguing "our new rules make it easier to compare offers and choose the best deal, without any nasty surprises".

The spokesperson added that "inflation might be low now, but as we've seen recently, it's difficult to predict and can be incredibly volatile – we don't think consumers should bear that risk," and that "for people claiming certain benefits, there are cheaper packages available known as social tariffs, which don't include any mid-contract price rises".

Could Hopcast cure net energy guzzling?

Device-to-device transfers may slash net energy grab

The world could save 99% of the energy spent on transferring data over the web if it moved to a system of device-to-device communication, according to a startup firm.

Hopcast, a company formed in 2022, claims to be the first mobile-specific content delivery network (CDN). Instead of constantly fetching data from remote servers all over the world, Hopcast's technology allows for device-to-device transfer of data – similar to systems such as Apple's AirDrop but without any user intervention.

This would both slash the amount of data users require from their mobile network and save a vast amount of energy, according to the company's co-founder and CEO, Farid Benbadis.

"On all Android phones, on all iOS phones, we have the capability to do device-to-device communication, but these resources are not used today," Benbadis told *PC Pro* at CES 2025. "With Hopcast, we orchestrate device-to-device communication... to distribute the content, instead of always going through centralised servers which can be thousands of kilometres apart."

Benbadis points to examples such as Netflix, where the release of *Squid Game* saw traffic handled by South Korea's internet providers multiply 24 times. Hopcast would be able to transfer those video files from device to device, without touching Netflix's own servers or CDNs.

"We anticipate encounters between people," claimed Benbadis. "We know, because we have some machine learning techniques... that there is chance that we meet, let's say this evening at 6pm at some location, maybe the supermarket. We say, okay, so this content, instead of sending it now, let's wait until 6pm, because they are going to meet."

ABOVE Files transferred via mobile devices could slash energy use

The Hopcast technology is the fruit of a 20-year collaboration between the French National Centre for Scientific Research (CNRS), Sorbonne Université and tech giant Thales.

The Interview

A light switch moment for smarter energy

Piers Daniell, Tewke

Tewke founder reveals to *PC Pro* how he's building a smart grid in the home

There are few technologies as simple or as ubiquitous as a light switch. Tewke founder Piers Daniell hopes that by replacing two or three of them in the home with his smart energy consoles – dubbed Taps – he'll be able to cut your energy bills in half. We met up at CES 2025 to find out how it works.

PC Pro: Where did you get the original idea for Tewke from?
Piers Daniell: I'd set a company up called FluidOne. We built data networks, and we were trying to put data over power lines, and it just opened my eyes to how antiquated our energy generation system is. So there's a real opportunity for a smart grid, where we optimise how we consume energy, and hence we can generate energy in a more efficient way.

PC Pro: Why have you built your console into a light switch?
Piers Daniell: So the idea with Tewke is, if we're going to build a smart grid, we need to do it in the home. We need to do it with consumers. But what we need is really granular detail, in terms of what everyone's doing and how they're doing it. And so the idea of reinventing the light switch was, if we could put technology into the light switch, we're in an amazing position within the home where we can cram it full of sensors – we can see everything from humidity to air quality, but also we can do energy management.

We can see consumption, not just on the device itself, but by talking to smart meters, plugs, anything else. We're working with the Matter standard, so that as more Matter devices become available, we can talk to them, and we really then understand individual products, what they're doing, how they're doing it.

PC Pro: What kind of energy saving are you able to achieve?
Piers Daniell: We're all about parasitic power, so reducing wasted energy, optimising when you use things, and giving real feedback to the user that's super simple. So, no configuration required, and at the same time becoming a touch point in the home where we consolidate this IoT mess that all sits on your phone, that my wife doesn't log into, that my children don't have access to.

> "If we're going to build a smart grid, we need to do it in the home"

We are pitching it as a control for a Lutron-style automation platform that doesn't require rewiring, can be retrofitted in seconds into any home and then allows us to do the energy optimisation behind the scenes. We've just literally started installing into homes. We're achieving a 50% saving on the energy bill and about a 30% saving on energy consumption.

PC Pro: How do you achieve that level of energy saving?
Piers Daniell: We tie it into a variable tariff. If you have a smart plug behind a dishwasher, we detect the dishwasher is turned on, we kill the smart plug immediately, the dishwasher remembers its profile, and we then pick the time when it should go back on. So it's very raw, it's not very smart, but it achieves a great level of saving, and that's with a dumb device. And it's the same with the lighting. We turn every light bulb into a smart light without needing to replace it with a Hue light bulb.

PC Pro: How does the device know when to switch things on or off?
Piers Daniell: When you're not in a room, we've got a Doppler radar in every device, and every device has nine sensors, so we can detect movement, we can detect presence, heating humidity. So when you've got a window open, we'll turn your heating off.

PC Pro: Why launch in the UK?
Piers Daniell: The UK is the best place to innovate for energy tech. We've got the highest adoption of smart meters in the world, 60% of us are using one. Germany doesn't have one residential smart meter installed yet. We have a nice plethora of energy providers. We have a really interesting adoption of green energy. We've got wind and solar deployed, which a lot of countries don't have yet. ●

RIGHT Tewke can monitor a whole range of things from a light switch

The A-List

The best products on the market, as picked by our editors

PC PRO A-LIST

PREMIUM LAPTOPS

Apple MacBook Pro M4

M4 beast from £1,599

from apple.com/uk

This M4 update to the already brilliant MacBook Pro line is an easy recommendation, so the big question becomes do you choose the 14in version from £1,599 or 16in from £2,499? And then how much do you upgrade, as Apple isn't afraid of high prices. But whatever you choose should last for years, and look great while it's doing it.
REVIEW **Issue 364, p50**

Apple Mac Book Air13in (M3)

Both the 13in and 15in MacBook Airs impress for speed, styling and battery life, but the 1.2kg 13in Air wins out of the two for its sheer portability. **From £1,299 from apple.com**
REVIEW **Issue 356, p54**

Asus Zenbook S 14 OLED

Asus pairs a Core Ultra 9 288V with a 72Wh battery to produce a laptop that lasts almost 20 hours on a charge. What's more, this 1.2kg machine looks (and feels) the business. **From £1,750 from scan.co.uk**
REVIEW **Issue 362, p46**

Asus ProArt PX13

With AMD's new Ryzen AI 9 HX 370 inside, this 1.4kg compact powerhouse offers incredible amounts of power. Add a fantastic OLED screen and RTX 4070 graphics and it's a winner. **From £2,000 from uk.store.asus.com**
REVIEW **Issue 361, p50**

BUSINESS LAPTOPS

Lenovo ThinkPad T14s Gen 6 (Snapdragon)

Copilot+ PC for £1,500 exc VAT

from lenovo.com

It's perhaps a controversial choice – and we wouldn't roll this out en masse – but if you're buying for executives or CTOs this cutting-edge Copilot+ PC, complete with a Qualcomm Snapdragon Arm processor, is a superb choice. Not only is it good value, it's light, it's fast and its all-day battery life is genuinely 24 hours.
REVIEW **Issue 360, p56**

Lenovo ThinkPad X1 Carbon Gen 12

The X1 Carbon range has stepped up a gear thanks to Intel's Core Ultra chips, and Lenovo matches it with the stunning build quality and keyboard you'd expect. **From £1,375 from lenovo.com**
REVIEW **Issue 358, p58**

Dell Latitude 9450 2-in-1

This 14in convertible, based around Core Ultra CPUs, lacks for nothing, whether that's speed, battery life (around 16 hours), build quality or flexibility. **From £1,560 exc VAT from dell.co.uk**
REVIEW **Issue 361, p63**

HP OmniBook Ultra Flip

A top-quality 2-in-1 with a terrific 14in OLED panel, great build quality and superb battery life thanks to Intel's latest generation Core Ultra 7 processors. **From £1,699 from hp.com**
REVIEW **Issue 365, p46**

COPILOT+ PCs

Lenovo Yoga Slim 7x (Gen 9)

AI on demand, £1,350

from lenovo.com

You won't find a better-value laptop, never mind one that meets the Copilot+ PC criteria. With a Snapdragon X1E-78-100 inside it isn't the fastest in benchmarks, but it's incredibly nippy in practice, the battery lasts over 16 hours and the 14.5in OLED screen is top quality.
REVIEW **Issue 361, p57**

Samsung Galaxy Book4 Edge

A classy 16in laptop that weighs 1.6kg, uses the fastest Snapdragon Elite X chip and delivers a solid 12 hours of battery life. **512GB, £1,499 from samsung.com**
REVIEW **Issue 360, p53**

Microsoft Surface Laptop, 7th Edition

The poster child for Copilot+ PCs offers quality, great looks and staggering battery life. **From £1,049 from microsoft.com**
REVIEW **Issue 360, p50**

Asus Zenbook S 15 OLED

With a price drop to £1,200 this 15.6in laptop becomes a viable competitor to the Yoga Slim 7x if you need a bigger screen. **£1,200 from uk.store.asus.com**
REVIEW **Issue 359, p52**

EVERYDAY LAPTOPS

Acer Aspire 14 A14-51GM

Compact power for £850

from acer.com

Want gaming power? Buy the version with RTX 2050 graphics for £850 (part code NX.KSVEK.005). Just care about value? Get a Core 5 processor and integrated graphics for £600 (part code NX.KRWEK.00B). Whichever you choose, it's a staggering laptop for the price.
REVIEW **Issue 359, p82**

Asus Zenbook 14 OLED (UX3405)

If you can stretch past £1,000, this is a top-quality Core Ultra laptop with a superb 120Hz screen and great battery life. **From £1,099 from uk.store.asus.com**
REVIEW **Issue 359, p58**

Framework Laptop 13 (DIY Edition)

With a competitive price, modular approach and easy-to-repair ethos, you can pick and mix your perfect 13in laptop. **From £779 from frame.work**
REVIEW **Issue 360, p58**

Huawei MateBook D16

It's big and certainly not bashful, packing an Intel Core i9 chip and a high-quality 16in panel – and surprisingly good battery life, too. **£1,000 from huawei.com**
REVIEW **Issue 359, p87**

CHROMEBOOKS

Samsung Galaxy Chromebook Plus (2024)

Core 5 power for £749

from samsung.com

The first truly desirable Chromebook since the Pixelbook, this is a top-quality laptop from the all-metal chassis to the 15.6in Full HD OLED screen. And thanks to Intel's Core 5 120U processor, it's fast enough to last for years.

REVIEW **Issue 364, p65**

Acer Chromebook Plus 515

This Chromebook Plus laptop is all about value. With strong speeds thanks to Intel's Core i5-1235U processor, and a good-quality 15.6in panel with a 1,920 x 1,080 resolution, Asus' Chromebook Plus 515 is ideal for families, students and business users, providing mobility isn't your main priority as it isn't particularly light at 1.7kg. **£429 from currys.co.uk**

REVIEW **Issue 356, p82**

Acer Chromebook Spin 714

If you're looking for a convertible, this is the best choice around. Others may beat the 12th gen Intel Core i5 we tested for performance, but for features, design and bang for buck you won't find any laptop that can match this 2-in-1 for the money.**£799 from currys.co.uk**

REVIEW **Issue 356, p83**

MINI PCs

Apple Mac mini M4

Little monster from £599

from apple.com/uk

This is a big and timely update for the Mac mini, with a much smaller (and squarer) design that's easy to tuck behind a screen. But what lifts it above the pack is the astonishing power of the M4 and M4 Pro chips, with barely any cooling required. As ever with Apple the upgrade costs are high, but at least its starting price is reasonable.

REVIEW **Issue 364, p44**

Geekom A8 Mini PC

Geekom makes brilliant use of AMD's Ryzen 9 8945HS in this powerful mini PC, which occupies little more desktop space than a drinks coaster. And it still packs every port most people need, plus Wi-Fi 6E. If you don't need this much power (or 32GB of RAM and a 2TB SSD) the Ryzen 7 version is £719. **Ryzen 9, £899 from geekom.co.uk**

REVIEW **Issue 359, p62**

Minisforum Venus UM790 Pro

Ignore its basic looks, for this compact system packs in a fast AMD Ryzen 9 7940HS processor, 32GB of DDR5-5600 RAM and 1TB SSD along with a generous selection of ports, including two USB-C 4 connectors. And the price is super-aggressive. **£549 from store.minisforum.uk**

REVIEW **Issue 363, p91**

ENTHUSIAST PCs

Wired2Fire HAL 9000 Compact PC

Mini powerhouse for £1,900

from wired2fire.co.uk

Wired2Fire proves there's no need to go big for top-level performance, squeezing a Ryzen 7 7900X and RTX 4070 Ti into a Cooler Master chassis measuring 185 x 295 x 377mm (WDH).

REVIEW **Issue 365, p59**

CyberPowerPC Infinity X145 Elite

Designed to deliver the maximum possible gaming power for £999, this Core i5-14400F system – with 32GB of DDR5 RAM and GeForce RTX 4060 graphics – is a great machine now with potential for more later. **£999 from tinyurl.com/360cyber**

REVIEW **Issue 360, p61**

PCSpecialist Nebula Goliath

The best possible debut for Intel's Core Ultra 285K processor, with PCSpecialist teaming it up with an RTX 4080 Super to provide a versatile system for gamers and creatives alike. **£2,399 from pcspecialist.co.uk/configure-review/629**

REVIEW **Issue 365, p56**

ALL-IN-ONE PCs

HP Envy 34 All-in-One

£2,099 widescreen wonder

from hp.com

Built around a high-quality 34in widescreen – which is perfect for viewing two windows side by side thanks to its 21:9 aspect ratio – this also comes with Nvidia RTX 3060 graphics. We're big fans of the magnetic 16-megapixel camera, too.

REVIEW **Issue 335, p46**

Dell Inspiron 24 All-in-One

Despite being built to hit a price point, the Inspiron 24 All-in-One manages to look classy, include a good-quality, 1,920 x 1,080 24in panel and have enough power to breeze through a typical day's tasks. It even packs mod cons such as a 720p webcam. Superb value for money. **From £599 from dell.co.uk**

REVIEW **Issue 350, p47**

Apple iMac M4

Anyone hoping for a 27in iMac will be disappointed, but everyone else should be delighted by this M4-powered all-in-one with its 24in 4,480 x 2,520 IPS panel. It's fast inside and out, too, with Thunderbolt 4 and Wi-Fi 6E on offer. **From £1,299 from apple.com/uk**

REVIEW **Issue 364, p48**

CREATIVE WORKSTATIONS

Armari Magnetar M64T7-AW1650G4

Threadripping power for £8,329 exc VAT

from armari.com

AMD's Ryzen Threadripper 7980X is the star of this particular show, dominating our benchmarks with the help of 128GB of RAM, two 2TB Crucial PCI-E 5 drives in RAID0 configuration and AMD's Radeon Pro W7800 professional GPU. And it's all wrapped up in a custom Armari case with liquid cooling.

REVIEW **Issue 361, p92**

PCSpecialist Quantum Goliath R

Extracting maximum power from its budget by opting for consumer components with professional levels of power, this well-thought-out workstation couples Intel's Core i9-14900KS with RTX 4090 graphics to tremendous effect. **£3,750 exc VAT from pcspecialist.co.uk/reviews**

REVIEW **Issue 361, p89**

Scan 3XS GWP A1-TR64

A more balanced offering than Armari's Magnetar, Scan mixes a Threadripper 7970X with Nvidia RTX 5000 graphics – and a stunning supporting cast of components with an equally stunning case. Perfect for real-time viewsets and GPU accelerated computation. **£7,917 exc VAT from scan.co.uk**

REVIEW **Issue 361, p94**

TABLETS

Apple iPad Air (M2)

M2 power from £599

from apple.com

We love the new iPad Pro, but for most people the M2 iPad Air is not only far better value but also all the tablet they'll need. It supports the Magic Keyboard and Pencil Pro, plus it's now available in both 11in and 13in sizes.
REVIEW **Issue 358, p50**

Apple iPad Pro (M4)

The best tablet in the world becomes even better thanks to Apple's stunning M4 chip, a gorgeous OLED screen and the must-have accessory: the all-new Pencil Pro. But it comes with an obvious downside of cost, with the cheapest 13in incarnation costing £1,299. **From £999 (11in, 256GB) from apple.com**
REVIEW **Issue 358, p48**

OnePlus Pad 2

Last year the OnePlus Pad took its place alongside Apple's iPads on the A List – and this year it's done it again, with superb battery life of over 18 hours, a gorgeous design and great power making this new version an even better proposition. All for a price that's exactly right. **£449 from oneplus.com/uk**
REVIEW **Issue 364, p86**

EVERYDAY PHONES

Motorola Moto G54 5G

Great looker for £180

from johnlewis.com

The 6.5in 120Hz IPS display is the G54's standout feature, but it improves on the previous generation in numerous ways while being even cheaper. It's faster, looks better, takes great photos and battery life is strong. You won't find better for less than £200.
REVIEW **Issue 355, p77**

Google Pixel 8a

We're fans of the Pixel 8 but you can save £200 and buy the 8a without missing out on any key features, including its advanced AI skills thanks to the same Tensor G3 chip inside. It's only when you zoom into snaps that you spot the camera quality difference. **128GB, £499 from store.google.com**
REVIEW **Issue 358, p74**

Samsung Galaxy A55

Not the fastest phone on the market, but in return you get a high-quality 6.6in OLED display, excellent battery life and a trio of strong cameras. And you also get four years of feature updates. With a price that significantly undercuts the Pixel 8a, it's great value, too. **128GB, £364 from johnlewis.com**
REVIEW **Issue 358, p77**

PREMIUM PHONES

NEW ENTRY

Apple iPhone 16 Pro

Class and quality from £999

from apple.com/uk

Even without Apple Intelligence, the introduction of a 5x optical zoom, classy 6.3in OLED panel and Apple's ludicrously fast A18 Pro chipset make this the best update to an iPhone Pro for years. The improved battery life is merely the cherry on top.
REVIEW **Issue 363, p70**

Honor Magic V3

With the Magic V3, not only does Honor make foldable phones as slim as flagship phones but also as affordable – so long as the £300 discount voucher still applies, as shown in the price here. What's more, the cameras and both OLED panels are superb. **£1,400 after discount from honor.com**
REVIEW **Issue 362, p62**

OnePlus 13

If you don't want to spend over a grand on a phone but you do want cutting-edge speed, lots of AI features, great cameras and superb battery life we have great news – not only does the 256GB version cost £899, but the 512GB option is £999. Look out for offers, too. **12GB/256GB, £899 from oneplus.com/uk**
REVIEW **Issue 366, p72**

EVERYDAY MONITORS

Iiyama ProLite XUB3293UHSN-B5

32in 4K bargain, £429

from currys.co.uk

The fact that this 31.5in IPS monitor could compete so well against Eizo's alternative (*see below*) says it all. Great colour coverage in sRGB and DCI-P3, USB-C and RJ45 inputs, plus solid build quality add up to a bargain.
REVIEW **Issue 357, p88**

AOC Q27B3CF2

AOC's relentless focus on value delivers a 27in 1440p screen with a high-quality IPS panel that costs £200 including VAT – and also packs in a USB-C port. Those are almost the only features you get, and the OSD is awful, but at this price we're not complaining. **£200 from amazon.co.uk**
REVIEW **Issue 360, p77**

Acer Verso B277 Ebmiprzxv

This is a basic but high-quality monitor, delivering colourful images across its 27in Full HD diagonal. You don't get USB-C docking, but it includes VGA, HDMI and DisplayPort inputs, plus a two-port USB hub. **£149 from tinyurl.com/357acer277**
REVIEW **Issue 357, p84**

PROFESSIONAL MONITORS

Eizo FlexScan EV3240X

Stunning 4K quality, £1,206

exc VAT from photospecialist.co.uk

With images that whack you between the eyes as soon as you lift it, fully assembled, from its box, this 32in 4K monitor is our top choice pick for anyone willing to make such a hefty long-term investment.
REVIEW **Issue 357, p91**

Eizo ColorEdge CG2700X

A brilliant choice for professional designers, whether working solo or in teams, thanks to its dedication to providing accurate colours across potentially years of life. It's also bang up to date for connectivity, with USB-C and RJ45 making it easy to manage, too. **£2,149 exc VAT from wexphotovideo.com**
REVIEW **Issue 357, p90**

BenQ PD2706U

If you can't stretch to Eizo budget levels then this 4K 27in screen is definitely worth investigating. It has several features aimed at professionals, including a Hotkey Puck to switch between profiles, plus great coverage of the sRGB and DCI-P3 gamuts. **£333 exc VAT from scan.co.uk**
REVIEW **Issue 357, p86**

WEBCAMS

Logitech MX Brio 705 for Business

Consistent brilliance for £219

from logitech.com

Consistent image quality in all lighting conditions coupled with top build quality and nifty features – such as a presenting mode for items on your desk – make this a fantastic all-round choice.
REVIEW **Issue 356, p68**

Logitech Brio 105 for Business

While you can buy 1080p webcams for a third of the Brio 105's price, they won't hold a candle to the Logitech webcam's quality – especially in low-light conditions, such as one candle. It's also easy to manage, for businesses and individuals.
£45 from logitech.com
REVIEW **Issue 360, p77**

Obsbot Tiny 2

This portable 4K webcam delivers for quality, design and sharpness, and it comes with a shedload of advanced features, including dynamic zoom and subject tracking. The only real downside is that it has a price that reflects its premium ambitions.
£329 from amazon.co.uk
REVIEW **Issue 352, p75**

HOME OFFICE PRINTERS

HP OfficeJet Pro 9135e

Do-it-all inkjet for £193

from printerbase.co.uk

This versatile inkjet all-in-one – which includes a 35-page ADF – pumps out high-quality prints at laser-rivalling speeds. Likewise scans and copies. Print costs are reasonable, too.
REVIEW **Issue 365, p85**

Epson EcoTank ET-2865

As usual with ink tank printers, you don't get many frills with the Epson EcoTank ET-2865 (so no ADF or screen). What you do get is incredibly low running costs of 0.5p for colour and 0.2p for mono, plus high-quality prints and scans.
£233 from uk.insight.com
REVIEW **Issue 365, p84**

Canon i-Sensys LBP243dw

Everything you could want from a mono laser printer – it doesn't come with a scanner – the LBP243dw produces excellent results at speed. You also get Wi-Fi and wired networking. **£186 from printerbase.co.uk**
REVIEW **Issue 365, p88**

WORKGROUP PRINTERS

Canon Maxify GX6550

Ink tank all-in-one for £392 exc VAT

from canon.co.uk

Designed to fit in tight spaces, this all-in-one includes a highly effective ADF and backs it up with high-quality prints at 24ipm in our tests. Running costs are superb, too.
REVIEW **Issue 350, p58**

Brother HL-L9430CDN

This laser printer (not an all-in-one, so there's no scanning or copying functionality) is a great choice for a busy office, producing sharp black text and making a good job of colour graphics as well. All while doing so quickly with a competitive price per page. **£415 exc VAT from printerland.co.uk**
REVIEW **Issue 353, p84**

Xerox B315DN

A fine alternative to the Brother and Canon, this mono laser multifunction printer produces superb results at great speed – 27.5 pages per minute in our 50-page test, which includes the spool time. It's similarly quick for scans, with a dual-CIS ADF to speed up double-sided copies. **£238 exc VAT from printerbase.co.uk**
REVIEW **Issue 341, p87**

WIRELESS ROUTERS

Netgear Nighthawk RAXE300

Fast Wi-Fi 6E router, £350

from amazon.co.uk

The RAXE500 is faster than the RAXE300, but in practice we doubt you would notice – this tri-band router still delivered speeds between 50MB/sec and 150MB/sec in our tests. And it's packed with features, too. At £150 cheaper than its bigger brother, we think it hits the Wi-Fi 6E sweet spot.
REVIEW **Issue 341, p68**

Netgear Nighthawk RS700S

Make no mistake – you won't get stunning speeds out of this Wi-Fi 7 router today. But if you must buy a router now and want future-proofing, this is a solid choice. But honestly, we would recommend that you wait.
£800 from netgear.com
REVIEW **Issue 353, p76**

Asus RT-AX59U

You can buy cheaper Wi-Fi 6 routers – such as the D-Link Eagle Pro AI R15 for £55 – but Asus' well-priced offering delivers strong performance along with lots of control and exceptional VPN support. **£125 from uk.store.asus.com**
REVIEW **Issue 350, p57**

MESH WI-FI

TP-Link Deco XE200

Clever Wi-Fi 6E for £400

from amazon.co.uk

There are cheaper Wi-Fi 6E meshes, but the XE200 wins for its superb download speeds, excellent coverage and the fact that older clients reap benefits of 6E, not just new ones. And a two-pack (code BOBKTDPWC8) should be enough for most premises.
REVIEW **Issue 349, p65**

Netgear Orbi 770

If you're eager to upgrade to Wi-Fi 7 then the Orbi 770 is the best mesh option yet. Its speed and range are both excellent, with a twin-pack covering 420m² (says Netgear), and the wired connectivity superb: four 2.5GbE connectors on the router unit, two 2.5GbE ports on the satellites. But it ain't cheap. **2-pack, £600 from amazon.co.uk**
REVIEW **Issue 364, p70**

Linksys Velop Pro 6E

Ironically, this Wi-Fi 6E router will get the most out of your non-Wi-Fi 6 devices thanks to its use of the 6GHz network for station-to-station traffic. And you only need two units for rock solid performance across a three-bedroom house. **2-pack, £380 from amazon.co.uk**
REVIEW **Issue 350, p54**

BUSINESS WI-FI

NEW ENTRY

Ubiquiti UniFi U7 Pro Max

Wi-Fi 7 AP, £214 exc VAT

from broadbandbuyer.com

A great choice for SMBs seeking a powerful and affordable upgrade to Wi-Fi 7. You'll need a UniFi controller to complete the wireless picture, but this investment will be paid back handsomely as they offer the best cloud management services around.

REVIEW **Issue 365, p100**

TP-Link Omada EAP783

This slim-line discus has a mighty BE19000 rating and will appeal to businesses looking to make an early transition to Wi-Fi 7. It delivers superb performance and is MLO-ready, while TP-Link's Omada cloud platform offers great remote management services. **£520 exc VAT from senetic.co.uk**

REVIEW **Issue 360, p103**

EnGenius ECW526

The ECW526 is a top choice for SMBs looking to make the move to Wi-Fi 7 as it combines a great feature set at a tempting price. Cloud management services are extensive, and its potent Qualcomm CPU and 10GbE port deliver superb wireless performance. **£225 exc VAT from solwise.co.uk**

REVIEW **Issue 366, p102**

NAS SERVERS

Synology DiskStation DS1823xs+

10GbE NAS, £1,413 exc VAT

from broadbandbuyer.com

This powerful eight-bay NAS is a great choice for SMBs that want plenty of capacity, features and performance at a reasonable price. The new DSM 7.2 software has security high on its agenda, and the icing on the cake is Synology's generous five-year warranty.

REVIEW **Issue 346, p101**

Qnap TS-h987XU-RP

The TS-h987XU-RP is a ready-made hybrid storage solution for SMBs. This rack-friendly package offers a great specification for the price, and Qnap's QuTS hero software scores highly for its wealth of data-protection features and business apps. **Diskless, £3,292 exc VAT from broadbandbuyer.com**

REVIEW **Issue 344, p96**

Synology DiskStation DS1522+

Small businesses that want a high-capacity desktop NAS at a good price will find Synology's DS1522+ a great choice. Performance over 10GbE is impeccable and the DSM software offers a fantastic range of storage features. **5-bay NAS, diskless £586 exc VAT from broadbandbuyer.com**

REVIEW **Issue 344, p98**

VIDEOCONFERENCING

Biamp Parlé VBC 2800

Go big for £2,918 exc VAT (MSRP)

from midwich.com

We thought the VBC 2500 was a great VC room bar, and the new VBC 2800 delivers Biamp's undeniable expertise to larger meeting rooms. Video and audio quality are outstanding, speaker framing is super fast and the smart combination of dual camera lenses makes sure everyone is in the big picture.

REVIEW **Issue 364, p98**

Owl Labs Medium Room Solution

The Owl 4+ and Owl Bar partnership offers smart tracking and dynamic split-screen views to ensure everyone is in the picture, while the Whiteboard Owl adds extra professionalism to presentations and training sessions. **Owl 4+, Owl Bar, TV mount, £2,999 exc VAT from owllabs.co.uk**

REVIEW **Issue 364, p100**

Ricoh Meeting 360

Ricoh's Meeting 360 is up against stiff competition in the panoramic meeting hub market but stands out for its excellent build quality and generous three-year warranty. It's easy to use and delivers good video and audio quality, while the smart app allows you to create a view for every occasion. **£744 exc VAT from amazon.co.uk**

REVIEW **Issue 364, p101**

SCANNERS

Xerox N60w Pro Scanner

Speed demon, £766 exc VAT

from tradescanners.com

The N60w Pro offers tremendous value and versatility. It delivered up to 67ppm in our tests with great output quality, offers a plethora of connection options and makes walk-up scanning a breeze.

REVIEW **Issue 358, p101**

Brother ADS-4500W

Ideal for small businesses, the ADS-4500W offers a fine set of walk-up scan features and its output quality is beyond reproach, while Brother's Print&Scan app delivers great scan workflow management options. **£295 exc VAT from printerbase.co.uk**

REVIEW **Issue 358, p98**

Epson WorkForce DS-800WN

A flexible desktop scanner with 50ppm pace and lots of connection options. Epson's software provides great scan management features, and support for Epson's Open Platform is a boon for document management. **£656 exc VAT from ballicom.co.uk**

REVIEW **Issue 365, p103**

SERVERS

Dell EMC PowerEdge T350

Xeon E-2300 power, from £1,399 exc VAT

from dell.com

Perfect for SMBs and branch offices looking for an affordable and powerful single-socket tower server. Along with support for Xeon E-2300 CPUs and lots of memory, it has a high storage capacity, plenty of expansion space and is sturdily built.

REVIEW **Issue 335, p98**

Dell EMC PowerEdge R250

With prices starting at around £850 exc VAT for a Pentium Gold CPU, and the option of Xeon E-2300 series chips from £1,461 exc VAT, this is a slim, rack-mounted alternative to the more high-powered T350 that's ideal for SMBs. **From £845 exc VAT from dell.com**

REVIEW **Issue 332, p98**

Broadberry CyberServe Xeon E-RS100-E10

This represents a powerful hardware package at a price that will please small businesses. We love its low-profile chassis and the fine selection of remote-management tools. It's a great alternative to the Dell EMC servers also listed here. **£983 exc VAT from broadberry.co.uk**

REVIEW **Issue 318, p96**

SECURITY SOFTWARE

NEW ENTRY

Avira Prime

Avira wins for all-round AV performance, plus a solid VPN, for a fair price. Watch out for a second-year hike to £91, though. **First year: 5 devices, £52 from avira.com**
REVIEW **Issue 366, p84**

NEW ENTRY

Bitdefender Total Security

A long-term award winner in our security suite Labs, Bitdefender continues to charm for its consistent AV performance, solid feature set and extremely competitive price. **5 devices, 1yr, £20 from store.pcpro.co.uk**
REVIEW **Issue 366, p85**

NEW ENTRY

Avira Free Antivirus

There's absolutely no need to pay for a full security suite if you only want antivirus protection, and Avira is our top choice simply due to its excellent and consistent performance in tests. **Free from avira.com**
REVIEW **Issue 366, p89**

VPNs

Surfshark

Reliably fast and goes out of its way to ensure that international streaming services work. Surfshark has a credible track record for privacy, too. **£55 for 27 months from surfshark.com**
REVIEW **Issue 360, p87**

NordVPN

One of the best all-purpose consumer VPN services around, and the paid-for version is packed with features – from anti-malware tools to a rather clever mesh file-transfer system. **£94 for 27 months from nordvpn.com**
REVIEW **Issue 360, p85**

Proton VPN

A great VPN in its own right, but also the best free VPN service as you get unlimited data. Instead, Proton restricts which endpoints you can access to only three countries: the USA, the Netherlands and Japan. **Free from protonvpn.com**
REVIEW **Issue 360, p86**

PASSWORD MANAGERS

NordPass

This hassle-free option is a great choice for both personal and business use, with a competitive price matched with all the features most people need. **£1.89 per month from nordpass.com**
REVIEW **Issue 350, p70**

Bitwarden

Free for individual use and open source, the only important thing Bitwarden lacks is phone support: it works with virtually every device and browser, and the paid option is well worth £10 per year. **Free from bitwarden.com**
REVIEW **Issue 350, p71**

Keeper

A great choice for businesses thanks to its focus on security and a zero-knowledge policy, and if you need more options then Keeper has them. **Business edition, from £2 per user per month from keepersecurity.com**
REVIEW **Issue 350, p72**

ON-PREMISES BACKUP

Nakivo Backup & Replication 10.11.2

Perfect for SMBs that want the freedom to choose their host system. It supports an incredible range of hardware platforms and OSes and is packed with data protection features. **Enterprise, 10 servers, perpetual licence, £1,118 exc VAT from nakivo.com**
REVIEW **Issue 362, p100**

Veritas Backup Exec 23

Backup Exec 23 is easy to manage, provides valuable ransomware protection and the subscriptions are great value. **Simple Core Pack, 5 instances, £498 exc VAT per year from uk.insight.com**
REVIEW **Issue 362, p101**

NETWORK MONITORING

NEW ENTRY

Progress WhatsUp Gold 2024

A great SMB choice as it presents a clear picture of your network and is available in a wide range of licensing plans. It's a cinch to deploy, doesn't require a lot of host resources and the new features make it even easier to customise. **Enterprise, 50 devices, £1,177 exc VAT per year from whatsupgold.com**
REVIEW **Issue 366, p100**

NEW ENTRY

Park Place Technologies Entuity 22

An impressive toolbox of monitoring services all easily managed from a web console that offers a wide range of informative dashboards. **From $150 per node/year from parkplacetechnologies.com**
REVIEW **Issue 366, p99**

VOIP SERVICES

3CX Phone System V20

Our top choice for businesses that want to manage their own VoIP system. It can be hosted in the cloud or on-premises, and has lots of new features. **Small Business, 10 users, £175 exc VAT per year from 3cx.com**
REVIEW **Issue 357, p98**

TelephoneSystems.Cloud

A great choice for businesses that know what they want from cloud-hosted VoIP services, offering a wealth of features at a good price. **From £11 exc VAT per user per month from telephonesystems.cloud**
REVIEW **Issue 357, p100**

ENDPOINT PROTECTION

WithSecure Elements Endpoint Security

A comprehensive set of protection measures for a great price, easily managed from a cloud portal. It supports a wide range of devices and the Luminen tool delivers AI-powered reporting services that present detailed summaries of events with a click. **100-499 devices, £37 exc VAT each per year from withsecure.com**
REVIEW **Issue 363, p101**

Sophos Intercept X Advanced

An unbeatable range of tough security measures. Deployment is a breeze, and a multitude of security policies make it highly flexible. **100-199 users, £48 exc VAT each per year from enterpriseav.co.uk**
REVIEW **Issue 363, p98**

REMOTE SUPPORT

NetSupport Manager 14.1

Sets the standard for on-premises hosted support for local and remote workers. It delivers a remarkable range of features and its one-time cost per seat will appeal to businesses concerned about subscription fees. **1-500 systems, perpetual licence, £10 each exc VAT from netsupportmanager.com**
REVIEW **Issue 361, p100**

ISL Online Standard

Perfect for SMBs wanting cloud-based support. Features and access security are excellent, as are its flexible licensing plans. **Standard Cloud/One user, £287 exc VAT per year from islonline.com**
REVIEW **Issue 361, p99**

SECURITY APPLIANCES

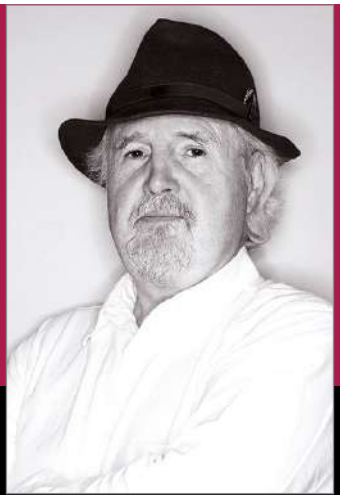
Firewalla Gold Pro

A great choice for small businesses that delivers a wide range of security features at a tempting price. Our 10GbE tests show it can easily cope with high demand, and you don't have to worry about subscriptions either, as the price includes all security services and lifetime updates. **$899 (£676) from firewalla.com**
REVIEW **Issue 364, p103**

DrayTek Vigor 2927Lax-5G

This affordable security router offers always-on internet access thanks to an unbeatable set of WAN redundancy features and also offers built-in Wi-Fi 6 services. **£667 exc VAT from broadbandbuyer.com**
REVIEW **Issue 360, p98**

The pod people have landed



Dick Pountain is editorial fellow of *PC Pro*. His Prague trip podcast can be found at tinyurl.com/366whisky. Find him on BlueSky at @dick-pountain

The changing fortunes of technology can be looked at exactly like the rise and fall of civilisations, and now is the time of the podcast

Allow me to be contrarian and suggest that 2024 was *not* the year of AI. Instead, for me at least, it was the year of the podcast. That's partly because I was exposed to AI rather early via Stable Diffusion in 2022, and was bored stiff of it by the end of 2023. But it's also because online services that had kept me amused for years, including Facebook and YouTube, started sliding down a sloppily slippery slope into irrelevance during 2024. Feeds filled up with unwanted sponsored guff and AI-generated fluff, while real friends abandoned platforms to be replaced by reels and clickbait that spread like digital cockroaches. In response, I began to consume more podcasts.

Just as reels were shrinking down to 30 seconds of inane pointlessness, podcasts started expanding into three-hour epics. Of course, our own excellent *PC Pro* podcasts, crafted by Barry, Tim, Darien, Lee, Jon and Rois, adopt a manageable one-hour format, probably the optimum length for normal attention spans, but several other podcasts I consume started at that length then got carried away.

Back in 2023 an old friend recommended an article about the Velvet Underground, of special interest to me as the first piece I ever had published was about my experience of working at Max's in New York in 1970 while they were the house band. This piece was on a podcast called "A History of Rock Music in 500 Songs" by Andrew Hickey, and it was three hours long.

Rather to my surprise, I listened to all of it and was riveted: Hickey's taste, depth of research, even his bluff Mancunian accent kept me enthralled. The episode on "White Light/White Heat" was only number 164 of the 500 he plans, in chronological order, but I was hooked and went back to listen from the beginning. Number 1 was on Benny Goodman Sextet's 1939 "Flying Home", the first record with electric guitar, played by Charlie Christian.

Andrew's early episodes ran to around 30 minutes, but soon zoomed past the hour and now are regularly split into two or more parts – for example, the Beatles and the Rolling Stones reached three hours. Thanks to his immense research efforts they remain engrossing. He's now at episode 177 and intends to finish with a song from 1999. At his current delivery rate, that should take him to 2050.

> "Have I ever podcasted myself? Only once, because I don't much like the sound of my own voice"

Another mega-podcast I've listened to all the way through is Paul Cooper's superb "Fall of Civilisations" about the rise and fall of empires throughout human history. He has an advantage over Andrew Hickey in that there are fewer of them, mostly long in the past, and he's covered most of them in 19 episodes. While not an academic historian, Cooper has invested a huge amount of effort in research and is an excellent presenter, making every episode informative and exciting without resorting to sensationalism.

Some online niggling about historical accuracy is only to be expected, but his interpretations are largely convincing, not grossly ideological or biased, and the video version of the podcast (free on YouTube at **tinyurl.com/366cooper**) illustrates his arguments with a well-curated montage of photographic, film and literary evidence on a par with the work of Adam Curtis. Turns out that my favourite dead empires were the Nabataean and the Pagan.

> "Just as reels were shrinking down to 30 seconds of inane pointlessness, podcasts started expanding into three-hour epics"

Cooper's series, available in both audio and video formats, raises the question of when a podcast is actually a vlog, although I don't much care. Among my favourites is a series of 80+ YouTube interviews with living musicians by the veteran jazz guitarist and producer Rick Beato, which is probably neither or both – but his interview with Rick Rubin is priceless.

Have I ever podcasted myself? Only once, because I don't much like the sound of my own voice. It happened this way: in 1990, my brother-in-law Pip Hills and I took a road trip to Prague in his 1937 Lagonda saloon to witness Václav Havel's inauguration as president of the Czech Republic. Following this trip another friend, Mark Williams, commissioned us to write about it for his magazine *The Classic Motoring Review*, and subsequently the Scotch Malt Whisky Society, which Pip had founded in 1983, asked to reprint our article in its magazine and accompany it with a podcast.

I charily agreed, and since I don't possess a professional-grade microphone, let alone a studio, I performed my part over my Chromebook's mic, using an audio editor called Lexis (my Android replacement for the wonderful Audacity, with which I had 20 years of experience). I managed a usable take after two attempts, even including a snatch of music by Smetana at a pivotal point. Judge for yourself from the link above whether a career in voiceovers beckons...

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AI can make art, but it's more fun when people do

Nicole Kobie is *PC Pro*'s Futures editor. She probably couldn't write a good song even with the help of AI.
@njkobie

A tech CEO reckons composers hate playing instruments so much that they'd give it up in favour of AI, but that doesn't quite ring true

Mikey Shulman needs to bake some cupcakes or sit down with some crayons and paper and doodle. He's the CEO of Suno AI, a tool for making music using AI. On a recent podcast, he said writing and recording songs takes too much time – you need to learn an instrument, practise it until you're good and maybe even learn production software. "I think the majority of people don't enjoy the majority of the time they spend making music," he suggested.

It's hard to think anyone would do a job like writing songs if they hated it. So this is clearly a man who himself gleans no joy from the act of creation. Getting caught up in writing, building, cooking or whatever is one of the great pleasures of life. The joy is in the making, not just the consumption.

There's a quote on this idea that's been meme-fied, so you may have seen it on social media: "I want AI to do my laundry and dishes so that I can do art and writing, not for AI to do my art and writing so that I can do my laundry and dishes." That's from the social account of fantasy author Joanna Maciejewska, and although she perhaps momentarily forgot the existence of dishwashers, it's spot on about the strange direction of AI development taking over creative work rather than the drudgery.

> "Getting caught up in writing, building, cooking or whatever is one of the great pleasures of life"

Shulman isn't entirely wrong, of course. Writing, for example, can be a ridiculously frustrating process – even physically painful. I'm not exaggerating: when I'm concentrating on figuring something out and putting it into words, I clench my jaw and grind my teeth and hunch over my laptop. (It's no coincidence that after writing my own book I needed fillings in three of my molars and remain permanently in need of a back massage. I wish this were a joke.)

I wouldn't appear to an outsider to be enjoying myself, but I love being caught up in an idea and following it, sinking into that creative, deep flow where time disappears. I'm not musically inclined – I was in the school band at high school, but they asked me to pretend to play during performances – but regardless of the sort of creation, the practice and striving to get better is what makes the journey worthwhile, not just the output.

Oh, but that's all so pretentious, isn't it? And a tool that opens up a bit of music creation to those without the skills or the desire to gain them is no bad thing. It doesn't stop those with musical skill or talent from composing their own work, after all.

But I do think that statement is evidence that Shulman, and by extension let's just assume the rest of AI company CEOs that think like him, haven't got a clue what normal people actually love about life.

Sometimes they're right about what we hate; Microsoft wants AI to automate your emails and even attend your meetings. That's good – no-one likes doing those things.

We've been begging for the death of email for years, and companies have implemented meeting-free days just to keep staff from quitting. If it can solve doing the dishes, too, even I'd shell out £25 a month for Microsoft Copilot.

But that's just one side of what Maciejewska noted: we want to stop emailing so we can do the good bits of our jobs, whatever they may be. We want to be creative, to learn things, to build something.

Perhaps that's one reason why AI-generated anything just looks so bland, so flat. AI is getting better at approximating something closer to thinking, by taking information, assessing it and then making a decision. But no human behaves like that; we feel our way through life.

There's more to it than just emotional limitation, however, even if we're just enjoying the output of someone else's creation. Most humans, perhaps not Shulman, would rather hear an imperfect version of their favourite song played live by their favourite band than simply listen to the studio recording on Spotify. Heck, we even still go to cinemas to see movies; my TV is great, the popcorn is free, there's no queue for the toilet, yet it still feels better. Being there matters.

> "AI is getting better at taking information, assessing it and making a decision. But no human behaves like that; we feel our way through life"

This morning, my kid drew a picture of a marshmallow. It was fabulous. If I showed it to you, you would never have guessed that it was a marshmallow. Generative AI would have made a much more accurate representation. But watching her create something herself, learning how to draw and hold a marker and all that, is much more rewarding than typing "draw marshmallow" into an LLM. (Plus, she did it using a "silly scents" marker that smells like a marshmallow, and that's very funny.)

Doing something ourselves is part of the fun. I'd rather write a terrible song, draw a mushy marshmallow or type out every word of a 115,000-word book with a clenched jaw than hand those moments of creativity to an AI, regardless of whether its output or mine is better.

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Big tech firms have no values

Barry Collins is a former editor of *PC Pro*. His personal values include not working on the Sabbath (football, innit) and donating 10% of his income to Tetley's. Email him at barry@mediabc.co.uk. @bazzacollins

The rush to throw money at Trump underlines the uncomfortable truth that technology lives in a moral vacuum

The notion that big tech firms have a set of values has always triggered my BS filter. Companies will do what's best for the bottom line. If that happens to coincide with what's best for the planet, society or its customers, great. But the buck comes first.

Never has that been more transparent than in the rush to throw money at Donald Trump's inauguration fund. Apple, Amazon, Meta, Google, Microsoft, OpenAI and Uber are among the companies that have all made $1 million donations to the fund, either directly or through their senior executives. That pays for one hell of a party.

It shouldn't matter if the top brass at these firms drank a little too much Dom Perignon on the big day, because several of them already seem to be suffering from memory loss.

OpenAI's Sam Altman was clearly hallucinating in 2016 when he wrote on his blog that "Trump's casual racism, misogyny, and conspiracy theories are without precedent among major presidential nominees", as he made a personal donation of $1 million.

Apple's Tim Cook cracked open the personal chequebook, too, instead of donating via the company, which seems even stranger given his personal criticisms of Trump policy. "As a proud member of the LGBTQ+ community, I am deeply concerned about laws being enacted across the country, particularly those focused on our vulnerable youth," he tweeted in 2022, in a none-too-opaque reference to US state laws targeting transgender people. "I stand with them and the families, loved ones, and allies who support them."

Well, now he's contributing to a whip-round for the president who said on the campaign trail that he plans to "get transgender out of the military and out of our elementary schools and middle schools and high schools". Anyone want to remind Tim what the "T" of LGBTQ+ stands for?

> "Facebook's new rules 'allow allegations of mental illness or abnormality when based on gender or sexual orientation'"

You might argue that the actions of the execs should be divorced from those of the company, and you'd have a point, except that Apple's diversity policy claims that "we're continuing to create a culture of inclusion, increasing representation across teams, and holding ourselves accountable at every level". Except CEO, it seems.

Perhaps none has bent the knee quite as readily as Mark Zuckerberg. Not only has the Facebook founder handed over his share of the kitty, but he's changed how the social network is moderated. Third-party fact-checking is coming to an end (in the US, at least); content moderation teams are being moved from the firm's HQ in California to Republican stronghold Texas "to help remove the concern that biased employees are overly censoring content"; and hate speech policies are being relaxed to the point where, according to a report from NBC, Facebook's new rules "allow allegations of mental illness or abnormality when based on gender or sexual orientation".

This is the same Mark Zuckerberg who was repeatedly shown joining the company's employees on Pride parades, who in 2016 said he had committed "to make Facebook a safe place for members of the LGBT community everywhere". The same Meta that has photos of employees brandishing a Pride banner plastered over its careers page is now happy for its users to brand them abnormal. It's not just hypocritical, it's morally vacuous.

> "It shouldn't matter if the top brass drink too much Dom Perignon on the big day, because several already seem to be suffering from memory loss"

Ah, the defenders of the Big Tech firms wail, these companies have no choice but to cosy up to Trump. No company wants to be at odds with its own government, and given Trump's vindictive nature, it would be crazy not to contribute. Besides, many of them donated to the Democrat inaugurations. It's just the done thing.

That's a pathetic, weaselly defence. You either have values or you don't. You either "help to protect democracy, and advance fair and inclusive societies", Microsoft, or you contribute to a party for the guy who tried to overturn an election defeat and openly mocks disabled reporters. You either believe there's "no limit to what we can do to help individuals, communities, and businesses mitigate and adapt to climate change", Google, or you stump up a million quid for the man who describes climate change as a "hoax". You either believe good leaders "seek diverse perspectives and work to disconfirm their beliefs", Amazon, or you back the guy who appoints his own children and fires those who stand up to him.

"It's a real and terrifying possibility that Trump actually believes much of what he says," wrote Sam Altman on his blog in 2016. It's a near certainty that the big tech companies believe nothing of what they say on their own "values" pages.

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Readers' comments

Your views and feedback from email and the web

Is that a fact?

I listened to episode 725 of the *PC Pro* podcast with great interest, specifically the conversation on the removal of Facebook's fact-checkers. In that discussion Rois outlined her views that the removal of Facebook's fact-checkers was a good step change and correction from Facebook to enable further free speech on the platform.

I felt she made a very valid point that those with certain views not considered in keeping with what the fact-checkers deemed acceptable are shut down and accounts are blocked, where the fact-checkers were moving far too much towards censorship. I also have great sympathy with those who are making points as part of a debate (even when I do not agree with them) who then experience abuse; this simply should not be allowed to happen in a civilised society.

Abuse of those with opinions similar to Rois is wrong, but how will these changes stop abuse being sent to those with an opposing opinion? I don't see any attempt to protect those on the other side in these changes. I am a happily married gay man and I thought the debates on this subject were concluded long ago. Instead, based on these changes, it appears that once again someone can legitimately say I have a mental illness.

m.facebook.com/
Donald J. Trump
17 hrs
Mail-In Voting, unless changed by the courts, will lead to the most CORRUPT ELECTION in our Nation's History! #RIGGEDELECTION
Get official voting info on how to vot the 2020 US Election at usa.gov.
Get Voting Information

ABOVE Facebook claims its removal of fact-checkers is to "protect free speech"

These changes have instilled in me a very small, but very real, sense of fear for the future, for my future. As Rois said, "the road to Hell is paved with good intentions". Is this change one of those good intentions?

Reuben Clarke

Cost of business

I read Rois' column (*issue 364, p116*) with interest as I have experience of what she describes. However, I disagree that businesses should be conveniently "transferring costs to suppliers", as when this is coming from an organisation such as the one she describes – a large bank with deep pockets – this seems wrong, doesn't it?

It's often not so much about transferring costs, although it certainly does do that, or even about moving the buck-stopping point further down the line. And as a bureaucratic box-ticking exercise it rarely improves the quality of the goods or services you are receiving, because the array of diktats, which I'm sure seemed like a good idea in the meeting room when talking about a "typical" supplier, will rarely apply to all suppliers, who are now expected to tick those boxes or be "off the list".

If the supplier is providing a unique line of business application or service, being axed would often be detrimental to both businesses anyway. So, really, ticking the boxes is just about giving the banks' legal guys an insurer other than their own to go knocking on the door of if things go pear-shaped!

Having trust in your supply chain is important, but surely companies should have a responsibility to kick the tyres of the services and goods they buy to make sure they're fit for purpose? They shouldn't just be conducting a responsibility-shirking exercise of making already very pressured suppliers carry the can by ticking a generic, and often overly draconian, list of requirements.

Alan Ingram

Contributing editor Rois Ni Thuama replies: The reality is that suppliers are failing to meet even the most basic cybersecurity requirements. For example, some suppliers haven't even configured their email properly. As a result, it's easy for criminals to phish the staff in the client firm. The fix – it costs the client firm a small fortune to train up their staff to detect the phishing email when the simplest measure would be to put in a tech fix on the supplier side. In other words, transfer the cost to the supplier. Not only does this demonstrate you care about your client, you also protect your own firm.

Classic hits

Tidying up my study I came across a dusty and worn looking set of Altec Lansing speakers (two desktop speakers, one large subwoofer) I got free with a Dell PC I bought 24 years ago. I was going to take them to the recycling centre but then decided I'd donate them to a charity shop if they still worked. Not only do they work,

Star letter

Crunch time for Windows 10

I read your Windows 10 EOL article (*see issue 365, p28*) with interest and a hint of shame. I have stuck resolutely to Windows 10 for a multitude of reasons, not least that it's hard to feel like your PC any more, what with the pushes to online accounts, adverts and incessant attempts to reinstall Teams, Office 365 and (for a while) Candy Crush. But mainly because I'm avoiding a decision.

Currently I've got TPM disabled in the BIOS to prevent Microsoft sneaking in the upgrade, but the real blocker to me is the licence confusion. My Win 10 installation is an upgraded boxed copy of Windows 7 Pro. Microsoft can't seem to answer what the status of that licence key will be once upgraded to Windows 11, and I'm at a loss as to whether I'll be able to reinstall Windows 11 or move it to another PC in the future – particularly important as the PC is creaking with problems for which the only solution seems to be a fresh install.

I've got a few months to make the decision, but at the moment it feels like a shift away from Windows is likely to be the outcome, which makes me a bit sad, having spent a terrifying three decades in the Microsoft ecosystem.

Ross Fleming

Editor-in-chief Tim Danton replies: Thanks, Ross. It sounds like you need to shift operating systems one way or another. It's worth seeing if your current licence will upgrade successfully, but if not I will politely point you to the *PC Pro* store (store.pcpro.co.uk), where you can pick up a full Windows 11 Pro licence for £79.99. Or you can look forward to next month's Labs, which is dedicated to Linux, including one that might be a better choice for Windows switchers than Mint...

This month's star letter writer wins a Cherry KC 200 MX mechanical keyboard, worth £80, recipient of a five-star review and a *PC Pro* Recommended award. Email letters@pcpro.co.uk

they sound amazing: no distortion, hiss or crackle, great sound across the range, the subwoofer is incredible, and the maximum volume frightening. Amazing quality no longer found nowadays as manufacturers churn out goods destined to end up in a landfill after only a few years. A crying shame. Oh, I'm keeping the speakers!
Cyrus

Kindle blockers

Flipping through issue 365, I was enjoying the review of the new Kindle Scribe and Paperwhite on p62/63 until I reached the end of the reviews and noticed they hadn't mentioned that the new Kindles have switched to using MTP, or Media Transfer Protocol, to transfer books via cable. This is a big issue for me and many other readers, as it means the Kindles won't show as a normal USB storage device on Mac or Android, and will need MTP software such as OpenMTP in order to transfer files to the Kindle – a slow and error-prone method of transferring files.

In addition, this new connection type prevents Calibre, popular E-library software, from sending page number data to your Kindle. This leads to an annoying situation where your books are stuck viewing the "time left" or "location" options while reading, an annoying method of gauging book progress. In addition, the "Download and Transfer" link on the Amazon website (previously used to let you download a copy of your book) no longer seems to function, either as a bug in new firmware or an intentional anti-piracy feature.

While I can understand Amazon wanting to reduce the number of pirated books on its hardware, I and many others who purchase ebooks from third-party sites can't help but feel sidelined by these changes to the 2024 Kindles. I feel this should have been mentioned in the review as it could potentially be a deal-breaker for many. Hopefully Amazon will update its next Kindle generation to enable these features again, as the Kindle reading experience is one of the most seamless and user-friendly on the market. Until then, a range of other e-readers are available, which have a greater propensity for sideloading.
Dylan Mitchell

Editor-in-chief Tim Danton replies: Thanks for pointing this out, Dylan. I'll make a note to check the status of MTP, or otherwise, the next time we review a Kindle.

Readers' poll

Do you listen to podcasts?

This was a two-part poll. First, we wanted a rough idea of how many *PC Pro* readers listened to podcasts, but second we were after recommendations. Particularly across technology, aside from our own *PC Pro* podcast, but we were open to ideas from further afield, too.

"Oh! You have a podcast!" wrote David J G Torrens, who now has an 18-year back catalogue of *PC Pro* podcasts to enjoy. "Just listening to the one about CES and have clicked subscribe. My others are the BBC and *Guardian* science podcasts and several TED ones... all the others are news, history and general interest ones, my favoured being Everything Everywhere."

We hadn't heard of Mark Warner's suggestion, but perhaps should point our Retro writer David Crookes towards it. "Advent of Computing. Really in-depth coverage of lots of interesting topics from computing's history." Kevin Peare, meanwhile, is a man after our own hearts. "Yes, I listen to the *PC Pro* podcast. It's the only one that I listen to, and have purchased some of the hot hardware recommendations. Hope you keep it going." We will, Kevin, we promise.

As well as the above podcast recommendations, our readers also suggested tech podcasts Security Now, TWiT (This Week in Tech), The Vergecast, The Artificial Human, Windows Weekly and This Week in Google. See the full responses at facebook.com/pcpro, and don't forget that you can listen to the weekly *PC Pro* podcast every Thursday at 1pm by signing up to our Discord server: pcpro.link/discord. Even if you don't like podcasts, there's a growing community of *PC Pro* readers gathering there, so it's a great place to chat – and throw shade at all our writers!

"Yes, varies, but none as regularly as *PC Pro*."
Chris Mark

"No. Just stick the radio on; if they're playing rubbish, switch to Spotify."
Martin Bailey

"Yes, but I only listen to *PC Pro* and Smashing Security."
Sean Dodd

"Yes, Still To Be Determined and various science podcasts."
Ken Brown

"Only *PC Pro* for tech (what else is there for IT?), but also the Tennis Podcast and football podcasts."
Andy Brown

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BEST LAPTOPS OF CES 2025

PLUS 44 OTHER RELEASES

We pick the 56 standout products and new technologies from this year's CES

Every year, CES acts as a calling card for all the great new technology due to be released in the coming year. It's the only place to be if you want to see what companies will be pinning their hopes on. You'll bump into everyone from PhD students with ideas fresh from research labs to directors of global tech firms. And CEOs, too, with Nvidia's Jensen Huang stealing much of the limelight, as we describe opposite.

CES takes place in Las Vegas, consuming two huge convention centres and speckling its way across many of Sin City's hotels. With the first briefings taking place on a Sunday and the show closing the following Friday, even with the assistance of our colleagues at Future Publishing – including brands such as *Laptop Magazine*, *LiveScience*, *TechRadar*, *Tom's Guide* and *Tom's Hardware* – it's a week-long battle to uncover the brilliant. And some that's just plain weird, as you'll discover if you turn to our segment on robots.

We dedicate 13 pages of this month's magazine to the show, and frankly you should see our discard pile. There are countless laptops, PCs, monitors and gizmos that failed to make the cut, with our aim being to give you the best possible taste (to misquote Kenny) of what CES offers. And if the 56 different products aren't enough to sate your appetite, then fire up your favourite podcast app and listen to the first entry from *PC Pro* in 2025 – courtesy of Barry Collins, Tim Danton and Jon Honeyball, who traipsed the halls and hotels on your behalf.

CONTRIBUTORS Barry Collins, Tim Danton and Jon Honeyball, plus Keumars Afifi-Sabet, Paul Alcorn, Jason England, John Loeffler, Hassam Nasir, David Nield and Anthony Spadafora

NVIDIA AT CES 2025

Jensen Huang's keynote at CES 2025 didn't disappoint, but it was only when we saw live demos using the new Nvidia cards that we appreciated what the company had achieved

Nvidia's RTX 50-series GPUs were arguably the biggest news of CES 2025, encompassing four desktop cards – the RTX 5090 ($1,999), RTX 5080 ($999), RTX 5070 Ti ($749) and RTX 5070 $549) – plus equivalent chips for laptops. But to get a true taste for what the cards could do, I went behind the scenes at a private Nvidia event.

DLSS 4 IS THE KEY

"Can it run *Cyberpunk 2077*?" has become the 2020s equivalent of "can it run *Crysis*?", and boy, can the RTX 5090 run *Cyberpunk 2077*. At maxed-out settings, I saw a peak of around 265fps and a low of 245fps. Every detail is crisp, the fidelity incredible and smoothness fantastic – and much is thanks to Deep Learning Super Sampling (DLSS) 4. This uses a machine learning model trained on the game to boost resolution and improve frame rates.

Nvidia's secret sauce is changing from a convolutional neural network (CNN) to a transformer model. A CNN relies on the layers it sees before it, which can result in ghosting (seeing the outline of a fast-moving item on screen follow behind it). A transformer model is similar to the LLMs powering ChatGPT and Google Gemini and, according to Nvidia, this "enables self-attention operations to evaluate the relative importance of each pixel across the entire frame and over multiple frames". In other words, this new version of DLSS can think a few steps ahead. The end result is far better frame rates and image quality. And this isn't hype.

The Super Resolution and Ray Reconstruction transformer models give the tiniest of details a real sense of existence in-game worlds. On top of that, the new transformer model is 40% faster and uses 30% less video memory. There is a tiny amount of latency, but nothing compared to previous generations. DLSS 4 features are coming to older GPUs too, but none will take advantage quite like the 50 series.

4090 PERFORMANCE IN RTX 5070?

My eyes lit up when Jensen claimed you're going to get the performance of the $1,599 RTX 4090 in the $549 RTX 5070, but surely that's too good to be true? Sort of. It comes down to the Multi Frame Generation aspect of DLSS that is exclusive to RTX 50-series cards. With DLSS 4 on the 50-series, the transformer model isn't limited to generating one additional frame, but can now generate three.

For comparison, Nvidia booted up *Marvel Rivals*. With an RTX 4090 generating one additional frame, you're seeing around 180fps; on a 5070, that goes up to nearly 250fps on the same settings. In other games, the two GPUs are more equal in terms of frames, with Nvidia picking *Marvel Rivals* for the demo due to it being exceedingly strong in frame generation.

And there's the twist. Jensen's claim depends on developers supporting Multi Frame Generation. If the game doesn't support it, then the RTX 4090 is still going to be better.

LEFT Find out what Project DIGITS is on p37

RTX IS GOING NEXT-LEVEL ON AI

Nvidia is going hard on the word "neural" with the RTX 50-series, and for good reason. For me, RTX Neural materials was the first standout feature when looking at the demos in person. Typically, game developers must bake in the texture of an object or surface and the rules of how it interacts with the rest of the world's lighting and ambiance. With RTX Neural materials, AI compresses that code and makes processing up to 5x faster. The end result is that multi-layered items such as silk look dramatically more realistic, with subtle colour changes that follow light diffraction.

Then there's RTX Mega Geometry, which massively increases the amount of triangles that build everything you see in a game for insane levels of granular detail. Typically, more detail means more VRAM, as this stores essential graphical instructions in the background that the game will need to constantly refer back to. These could be anything from textures to lighting, facial expressions to animations.

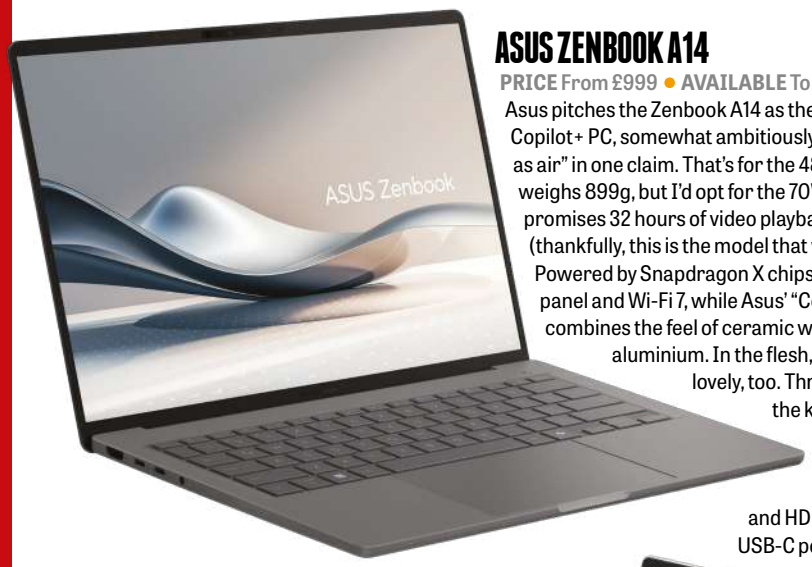
The RTX 50 series' onboard AI means textures can be compressed to save up to seven times of that previous video memory, while the Neural Materials feature works in tandem to process materials up to five times faster. Some key textures in the demo Nvidia showed me dropped from 47MB to 16MB. That's a huge reduction that also frees up the memory needed for Mega Geometry.

OUTLOOK

Nvidia deserves all its headlines. Games of today can render faster, look sharper and run smoother. Games of the future could be packed with so much detail it would take you pressing your face on the screen to actually find the pixels. JASON ENGLAND

BEST LAPTOPS

With new silicon from AMD, Intel and Nvidia, CES 2025 saw an unprecedented number of stylish and powerful new laptops. Here's our roundup of the best debuts



ASUS ZENBOOK A14

PRICE From £999 ● **AVAILABLE** To be confirmed

Asus pitches the Zenbook A14 as the world's lightest Copilot+ PC, somewhat ambitiously describing it as "light as air" in one claim. That's for the 48Wh version, which weighs 899g, but I'd opt for the 70Wh model as that promises 32 hours of video playback per charge (thankfully, this is the model that will be sold in the UK). Powered by Snapdragon X chips, it packs a 14in OLED panel and Wi-Fi 7, while Asus' "Ceraluminum" material combines the feel of ceramic with the lightness of aluminium. In the flesh, it looks genuinely lovely, too. Three final plus points: the keyboard is nice and crisp, the trackpad is large, and you still benefit from USB-A and HDMI, along with two USB-C ports. TIM DANTON

LENOVO THINKPAD X9

PRICE & AVAILABILITY To be confirmed

Prepare to be shocked: this new ThinkPad series doesn't include a TrackPoint. And – gasp! – it's finished in dark grey rather than trademark black. It's all part of Lenovo's attempt to attract a younger breed of buyers to its most famous business brand, and if you think the picture above resembles a MacBook that's one reason why. It also enables Lenovo to include a haptic touchpad, while a spokesperson told me that studies show more people prefer the X9's scissor-style keys than the traditional ThinkPad action (I'm not one of them).

The other big innovation is a discrete "hub" on the chassis bottom with dual fans to keep the Core Ultra 200V vPro chips running at their peak. This allows Lenovo to keep the rest of the chassis as thin as 6.7mm.

The X9 will come in 14in and 15.3in versions, with respective weights of 1.2kg and 1.45kg. Either way, your eyes will thank you for a 2,880 x 1,800 resolution, OLED technology and 120Hz refresh rates. The final plus: a 5MP webcam with a two-micron sensor, well suited to video capture in low light. TIM DANTON

HP ELITEBOOK X G1I 14IN

PRICE From $1,999 ● **AVAILABLE** From February 2025

HP's refreshed EliteBook range is rather tame compared to the HP ZBook Ultra G1a 14 opposite, but this sleek 1.4kg laptop will appeal to business buyers. HP is pushing its AI features – it meets Microsoft's Copilot+ PC criteria – and don't dismiss them as I expect HP's AI Companion app to turn into a handy helper over the years. The 14in, 120Hz, 2,560 x 1,600 touchscreen covers 100% of the DCI-P3 and Adobe RGB gamuts, HP claims, with Intel's Core Ultra 200V chips inside. Also look out for the "Ultra" version, which will come with a choice of Intel and Qualcomm chips and replaces the Dragonfly series. TIM DANTON

ASUS EXPERTBOOK B5

PRICE & AVAILABILITY To be confirmed

I've long been impressed by the build quality and value of Asus' ExpertBook range. I don't yet have a price, so can't talk about the latter when it comes to its new flagship business laptop, but the sturdy all-aluminium chassis (I'm told it's resilient to 1.2m drops along with passing all the usual MIL-STD-810H tests) makes me confident it will last for years of abuse.

Asus also talks a good game for sustainability, with a battery that can be replaced without tools, while a unique QR code reveals each laptop's carbon footprint. Based around Intel's Core Ultra 200V vPro chips (*see p33*), and with a 63Wh battery, it will easily last a full day of work, and there's plenty here for IT directors, too: ExpertGuardian to protect against cyber attacks, extra BIOS protection and Windows 11 Secured-core PC technologies to name but three.

Perhaps most importantly, end users will enjoy typing on the firm keyboard and gazing at the 14in 144Hz OLED screen (an option, so we'll see if that hits the UK). Choose the Core 9 Ultra version with 64GB RAM and a 2TB SSD – there's a second M.2 slot, too – and you have one compelling system for even your most demanding users. TIM DANTON

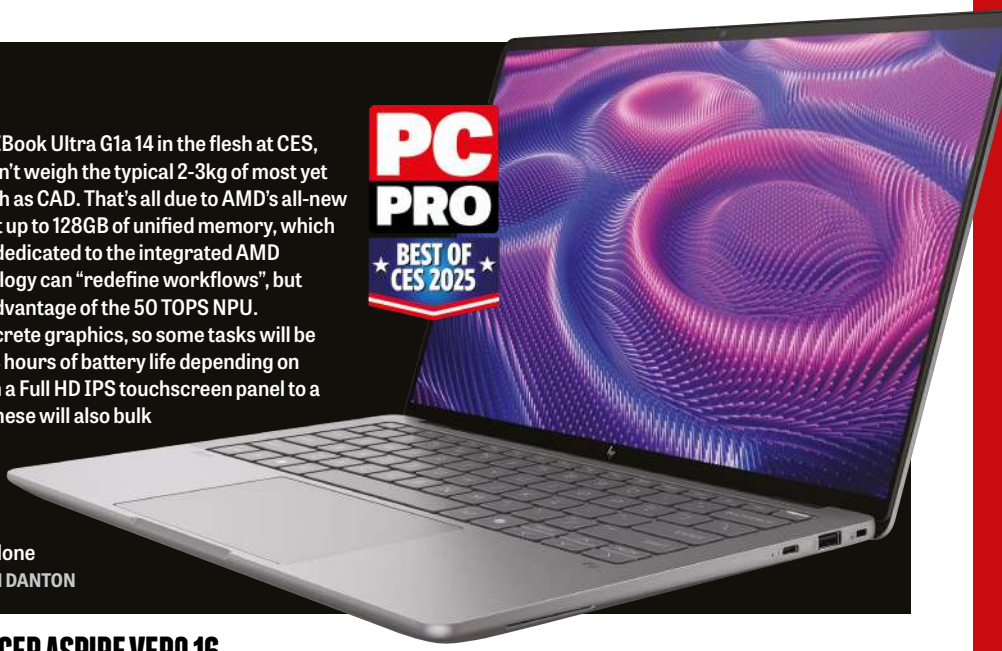
HP ZBOOK ULTRA G1A 14

PRICE To be confirmed • AVAILABLE Spring 2025

Yes please. That was my simple reaction to seeing the ZBook Ultra G1a 14 in the flesh at CES, because this self-proclaimed mobile workstation doesn't weigh the typical 2-3kg of most yet still packs the power required to tackle hefty tasks such as CAD. That's all due to AMD's all-new Ryzen AI Max Pro processors (*see p32*), which support up to 128GB of unified memory, which is a fancy way of saying that up to 96GB of RAM can be dedicated to the integrated AMD Radeon graphics. HP also reckons the Ryzen AI technology can "redefine workflows", but that very much depends on software vendors taking advantage of the 50 TOPS NPU.

There isn't space inside this slender chassis for discrete graphics, so some tasks will be best left to bulkier workstations, but HP claims up to 14 hours of battery life depending on usage and which screen you choose. These range from a Full HD IPS touchscreen panel to a choice of two QHD OLED panels, and no doubt adding these will also bulk up the price – a subject on which HP remains quiet.

With Wi-Fi 7, up to 4TB of storage and a decent selection of ports (one USB-A, two Thunderbolt 4, one USB-C 3.2 Gen 2 and HDMI 2.1) and a stylish dark grey design, it's hard not to be wowed by what HP has done here. Especially when you consider it weighs 1.5kg. **TIM DANTON**



LENOVO YOGA SLIM 9I (14IN, GEN 10)

PRICE & AVAILABILITY To be confirmed

If you love phones that include an all-round glass finish then take note of the new 1.2kg Yoga Slim 9i, designed to catch the light like jewellery. Lenovo assured me it won't break, unless you count onlookers' hearts. It also features a 32MP camera mounted behind the screen, which means that when you're on video calls you won't have that faraway gaze. Everything else is typical of Lenovo's top-end consumer laptops, including 1.5mm key travel, a 4K 120Hz OLED panel and kick-arse speakers. It also ticks the Copilot+ PC box with Core Ultra 200V chips. **TIM DANTON**

ACER ASPIRE VERO 16

PRICE From €1,199 • AVAILABLE Q2 2025

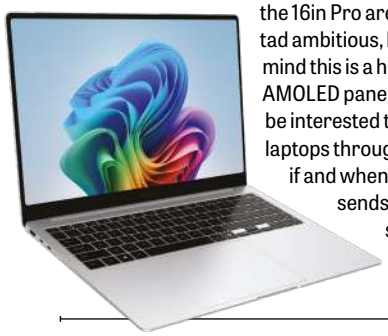
It's great to see Acer expanding its sustainability-focused Vero line, this time updating the chassis of its 16in laptop to be smoother and a shade more stylish as a result. It features Intel's new Core Ultra 200H Series processors (*see p33*), and with up to 99 TOPS there's plenty of local AI power. That sadly means the memory – up to 32GB – can't be replaced, but the SSD can, and overall this laptop has been designed for easy repair. There's no getting away from the fact that the most sustainable laptop is the one you already own, but if you're looking to invest in a "green" laptop that will last for years then this is a top choice. **TIM DANTON**

SAMSUNG GALAXY BOOK5 PRO 5

PRICE & AVAILABILITY To be confirmed

Samsung announced the global release of its Book5 Pro and Book5 Pro 360 at CES 2025, so I visited its stand to take a look. And, well, it's fine. Sleek, silver and sexy, like all previous Galaxy Books. The key upgrade is the switch to Intel's Core Ultra 200V Series chips, which should solve one of my biggest criticisms of predecessors – their battery life.

Samsung's 25-hour claims for the 16in Pro are perhaps a tad ambitious, bearing in mind this is a high-resolution AMOLED panel, so I'll be interested to put the laptops through their paces if and when Samsung sends me review samples later this year. **TIM DANTON**



LENOVO THINKBOOK PLUS GEN 6 ROLLING LAPTOP

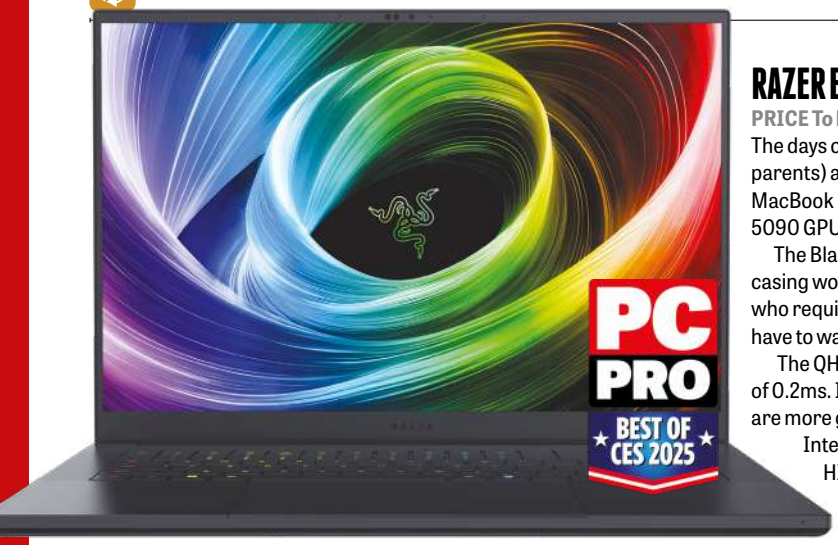
PRICE From $3,500 • AVAILABLE From June

Ignore the silly "Gen 6" suffix Lenovo's saddled this laptop with – there's never been anything quite like it before.

The ThinkBook Plus Gen 6 is the first laptop we've seen with a rollable screen. Although even rollable isn't quite the right word here, more slideable, as the screen slithers under the keyboard when it's not fully extended. Pressing the button or performing the gesture that extends the screen sees it shoot upwards from a 14in to a 16.7in diagonal. And though that doesn't sound like an awful lot of extra screen space, it boosts the resolution from 2,000 x 1,600 to 2,000 x 2,350, which is getting on for 50% more display on which to work.

That extended tall screen certainly looks odd, and the noise the motor makes as it's rolling the screen upwards will catch people's attention, too. However, there's no doubt that portrait format could be beneficial for work on documents, coding or even basic web surfing. Whether it's worth the extra weight (1.7kg is a good 300-400g more than a regular 14in laptop) or $3,500 asking price is more questionable, however, not least given how cheap portable screens are becoming.

BARRY COLLINS



RAZER BLADE 16

PRICE To be confirmed • AVAILABLE Q1 2025

The days of gaming laptops that are thicker than the Yellow Pages (teenagers, ask your parents) are numbered. The new Blade 16 is almost physically identical to a 16in MacBook Pro, so slender that it's hard to fathom that Nvidia's top-of-the-range RTX 5090 GPU is tucked somewhere inside this thing.

The Blade 16 is the very opposite of a gaudy gaming laptop. It's demure black metal casing wouldn't look out of place on an office desk, which is handy for professionals who require the graphics grunt. How well that slender casing copes with cooling will have to wait for the review, however, as the graphics chip alone can demand 155W.

The QHD+ OLED display is a stunner, with a 240Hz refresh rate and a response time of 0.2ms. Its factory-calibrated colour profiles for Adobe RGB, DCI-P3 and Rec. 709 are more good news for those thinking of excuses to buy this beyond gaming.

Intel's been thrown overboard for this 2025 model, with up to an AMD Ryzen AI 9 HX 370 inside, along with up to 64GB of non-replaceable 8,000MHz LPDDR5X RAM. It will come in various configurations, none of which will please the Money Saving Expert. **BARRY COLLINS**

ACER SWIFT GO 14/16 AI

Go 14: PRICE From €1,249 • AVAILABLE Q2 2025
Go 16: PRICE From €1,299 • AVAILABLE Q2 2025

Following the hot trend for laptops at CES, the Go 14 and Go 16 both include punchy OLED panels. They will come in a variety of resolutions, but from what I saw at the Acer stand you can expect excellent colours and rich blacks. No shock there. Nor is there in the sleek chassis, with the 16in version weighing 1.5kg with a promise of up to 22 hours' battery life and the 14in Go dropping to 1.3kg but upping life expectancy to 27 hours. This makes the smaller version more attractive, especially as both pack Intel's Core Ultra 200H Series chips, Wi-Fi 7, two Thunderbolt 4 ports and a promising-sounding 1440p webcam. **TIM DANTON**

MSI STEALTH 18 HX AI

PRICE To be confirmed • AVAILABLE Spring 2025

We could have included countless gaming laptops released at CES 2025 (Acer, Asus, Dell and Lenovo all released multiple models), but I single out the MSI Stealth 18 HX AI due to its focus on creators as much as gamers. Nvidia's latest GPU arguably offers as much of an upgrade for video editors and designers as it does for gamers, and the Stealth 18 HX AI supports the top-end RTX 5090. You also benefit from an 18in mini-LED display in a 2.9kg frame – lightweight considering what's within, which includes your choice of the new AMD Ryzen AI Max or Core Ultra 200HX CPUs. Cracking speakers complete the package. **TIM DANTON**

DELL'S NEW STRATEGY AND LAPTOPS

Farewell old friends. I refer, of course, to Dell's XPS, Inspiron, Latitude and Precision brands, which have been sacrificed on the Apple-esque altar of simplicity. Now you have to pick between Dell, Dell Pro and Dell Pro Max ranges, each with the choice of Base, Plus and Premium options. So perhaps not quite Apple-esque simplicity.

So, what does it actually mean? Plain Dell, equivalent to ye olde Inspiron, is for value buyers. Unless you choose Dell Premium, which is basically the XPS range. Dell Pro is basically a rebadged Latitude range, so you get more manageability features for business rollouts. And Dell Pro Max is the new name for workstation-class products, previously known as Dell Precision.

RIGHT The new Dell 14 Plus, formerly Inspiron Plus

RIGHT Dell's Pro Premium range replaces its high-end Latitude

Aggravatingly, Dell wasn't at CES, so I couldn't get my hands on the nine models it announced. Dell's first UK releases are all from the Pro range, with the Dell Pro 13 Premium starting at £1,530 exc VAT, the Dell Pro 14 Plus £1,192, the Dell Pro 14 Premium at £1,514 and the Dell Pro 16 Plus a snip at £1,192. It's no coincidence that all four use Intel's new Core Ultra 200V Series with vPro (*see p33*). They all meet Microsoft's Copilot+ PC criteria, too.

Of all the new laptops, the Pro Premium models look the most interesting. These include modular ports for easier repair (inspired, Dell says, by its Project Luna environmental initiative), while the tandem OLED available on the 14in model is, to quote Dell's Sam Burd, "nearly 25% more power efficient, 12% thinner and almost 50% lighter than a traditional OLED".

Dell says it will release the full range of new laptops over the coming months, so I look forward to getting them in for review.

Now that Dell has committed to this new branding strategy – which extends across all its hardware, including monitors – I can't see it backing down. Personally, though, I find it odd to abandon the years of equity and trust that Dell has built up via its XPS branding in particular, even accepting the argument that this new structure makes it easier for people unfamiliar with Dell's historic products to pick what's right for them. TIM DANTON

BEST MINI PCs

ACER REVO BOX AI

PRICE From €899 • AVAILABLE Q2 2025

If you needed any more indication that mini PCs are the hottest of hot potatoes, welcome to the Revo Box AI. Acer has sold compact PCs in the UK before, for business use, but this is its first mainstream offering to match the likes of Geekom and Minisforum. It measures 0.75 litres, weighs around 500g and includes a Core Ultra 200V processor, so meets the Copilot+ PC spec. You can add up to 32GB of RAM and 1TB of storage, while the dual 2.5GbE ports add welcome flexibility. And unlike most mini PCs, Acer is also including a wireless keyboard and mouse in the package. TIM DANTON

GEEKOM QS1 PRO

PRICE & AVAILABILITY To be confirmed

It should be no surprise that a mini PC specialist is among the first to sell a system based around Qualcomm's Snapdragon platform, in this case the 12-core X1E-80-100. All the usual caveats apply about performance – blistering in multitasking, not so great at 3D acceleration – but with a 45 TOPS NPU for local AI tasks I'd be happy with this as my main system. It resembles the Geekom A6, but note the four microphone slots and that there's space for two M.2 SSDs. It also comes with Windows 11 Pro, a three-year warranty and dual 2.5GbE ports. All we need now is a price and on-sale date. TIM DANTON

HP Z2 MINI G1A

PRICE To be confirmed • AVAILABLE Spring 2025

While I love the HP ZBook Ultra G1a 14 (*see p29*), if you're after even more power you should turn to its mini PC sibling, the glorious HP Z2 Mini G1a. The "a" stands for AMD, as it includes the Ryzen AI Max Pro. That means up to 16 cores and 32 threads for smooth running, and if you specify its maximum 128GB of RAM then 96GB can be dedicated to graphics. Other neat tricks include an integrated PSU – much neater than an external block – and two "Flex IO" ports, along with all the connectivity you'd hope for. For demanding users, perhaps wanting to run local LLMs, it's a great choice. TIM DANTON

LENOVO THINKCENTRE NEO 50Q

PRICE From $849 • AVAILABLE February 2025

Lenovo is the first big-name manufacturer to create a mini PC based around the new Snapdragon X chip (*see p32*), and interestingly it's targeting businesses with this 1.2-litre box. There's room for two M.2 SSDs inside, while numerous office-friendly ports sit at the rear: DisplayPort, HDMI, four USB-A and a gigabit Ethernet port. A further USB-A port sits alongside a USB-C connector at the front (plus a 3.5mm combo jack). In the flesh it's not what I'd call a looker, but its sleek dimensions mean it should fit into most spaces – or behind a monitor. TIM DANTON

MINISFORUM A1 X1 PRO MINI PC

PRICE & AVAILABILITY To be confirmed

I'm very much hoping that I can persuade Minisforum to send the A1 X1 Pro in for review when it eventually lands, as on paper it looks like a cracking mini PC. Based around AMD's Ryzen AI 9 HX 370 CPU, part of the new Ryzen 300 Series (*see p32*), it includes an NPU rated at 50 TOPS, supports up to 96GB of memory, and you can add up to 12TB of storage via three M.2 slots. And an OCuLink port sits ready for an external GPU should AMD's Radeon 890M graphics prove too weak for you. We await further details such as price or a release date, but head to **tinyurl.com/366minis** for a $50 "launch day special" coupon. TIM DANTON

MSI CUBI NUC AI+ 2M

PRICE & AVAILABILITY To be confirmed

It may not look like a business PC, but that's the target MSI has in mind with its Cubi NUC mini PCs (so far, at least), with the NUC AI+ 2M offering much to entice IT teams looking to simplify their setups. This 0.83-litre system is VESA mountable, includes Intel's Core Ultra 200V chips (up to the 258V), and at the rear you'll find a pair of 2.5GbE ports along with two Thunderbolt 4 ports. One of these supports power delivery up to 100W, and if you buy an MSI monitor you can even switch the Cubi on via its power switch. There's also a built-in mic and speaker to make video calls simpler. TIM DANTON

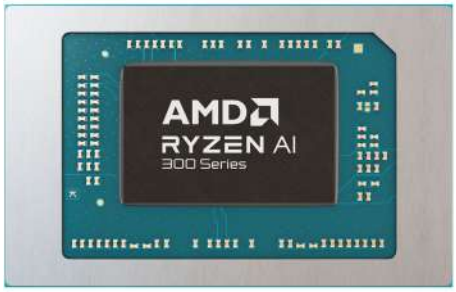
GEEKOM A6

PRICE £599 • AVAILABLE Now

When I met with Geekom representatives at CES, they had one thing on their mind: the A6. Designed to offer great value from the off, its list price of £599 (discounted to £499 at the time of writing) buys you a powerful Ryzen 7 6800H CPU, 32GB of DDR5 RAM, a 1TB SSD and Windows 11 Pro. The 6800H is a couple of years old now, so doesn't include Ryzen AI, but with eight performance cores and 16 threads it will easily cope with everyday demands for years to come. With a three-year warranty and Geekom's usual sturdy magnesium alloy chassis, this is a mini PC for bargain hunters. TIM DANTON

BEST CPUs

Both AMD and Intel revealed a host of new processors at CES, with Qualcomm not to be left behind with its Snapdragon X chips



AMD RYZEN 200 AND AI 300

PRICE Not applicable • **AVAILABLE** Q1-Q2 2025

Alongside its powerful Ryzen AI Max and 9000H/HX CPUs, AMD launched two mainstream mobile CPUs at CES: the Ryzen 200 and AI 300 Series.

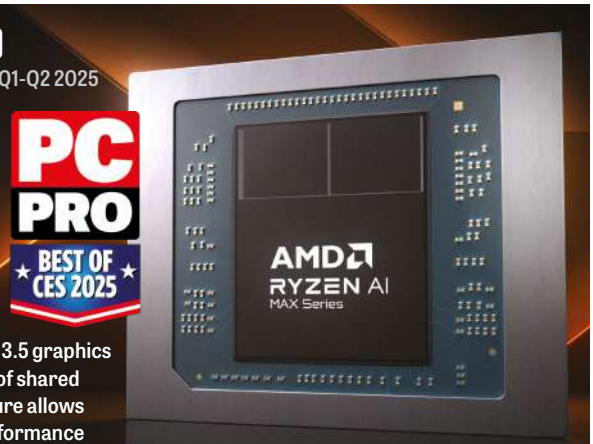
The budget 200 series is an update to the Ryzen 8040 series. It lacks the AI moniker as – at best – it includes an NPU rated at 16 TOPS. These chips are based on AMD's Zen 4 architecture, using a mix of Zen 4 and Zen 4c (so more efficient) cores. The Ryzen 3 210 sits at the bottom with four cores, eight threads and no NPU, while the Ryzen 9 270 tops the list with eight cores, 16 threads and the NPU.

The Ryzen AI 300 series is more interesting, based on Zen 5 architecture (using a mix of Zen 5 and Zen 5c cores) and wielding a 50 TOPS NPU to meet the Copilot+ PC threshold. AMD reckons the Ryzen AI 7 360 offers the fastest multitasking in its class, being 30% than the Qualcomm X Plus X1P-42-100 and 54% faster than Intel's Core Ultra 7 258V in Cinebench R24. The Ryzen AI 7 350 (eight cores, 16 threads) and Ryzen AI 5 350 (six cores, 12 threads) will be available in Q1.

Most of the Ryzen 200 and Ryzen AI 300 series will also be made available in Pro versions, which hints at the growing importance of commercial laptops in AMD's strategy. HASSAM NASIR

AMD RYZEN AI MAX/MAX PRO

PRICE Not applicable • **AVAILABLE** Q1-Q2 2025



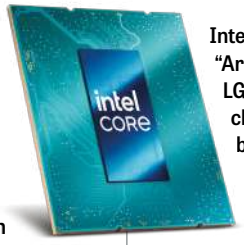
PC PRO BEST OF CES 2025

AMD has created a monster with its "Strix Halo" Ryzen AI Max series of laptop processors. Designed for thin-and-light gaming and AI workstation laptops, and featuring what AMD bills as the fastest integrated graphics in the Windows ecosystem, the flagship Ryzen AI Max+ 395 features 16 CPU cores, 32 threads and 40 RDNA 3.5 graphics cores, with support for up to 128GB of shared memory. AMD claims this architecture allows for up to 1.4 times faster gaming performance than Intel's flagship Core Ultra 9 288V and up to 84% faster rendering performance than the Apple MacBook M4 Pro. Additionally, says AMD, the AI Max+ 395 delivers up to 2.2 times more performance in AI workloads than the Nvidia RTX 4090 GPU, all with an 87% lower TDP.

The series includes four SKUs, all featuring a 55W base TDP that's configurable from 45W to 120W. The AI Max 390 includes 12 CPU cores and 40 graphics cores, the 385 packs 12 CPU and 32 graphics cores, while the AI Max 380 Pro includes six CPU cores and 16 graphics cores. The "Pro" indicates that it supports AMD's Ryzen Pro technologies, described opposite. Now we must hope AMD delivers. PAUL ALCORN

INTEL CORE ULTRA 200S

PRICE Not applicable • **AVAILABLE** Now



Is it just me, or is it getting harder to understand Intel's naming strategy? Buried among its announcements at CES was an extension to its Core Ultra 200S Series desktop chips, all of which are non-K models (so they can't be overclocked). For example, there's the Core Ultra 9 285 rather than the Ultra 9 285K. Muddying the waters is that some of the new chips are "Bartlett Lake-S", which are backwards-compatible with Intel's LGA 1700 boards, while others are "Arrow Lake-S", which need the newer LGA1851 socket and an 800-series chipset. The new chips are designed to be more affordable than their "K" counterparts, while still delivering the high levels of performance that demanding users would expect – including AI workloads. Just note that the NPUs aren't powerful enough to meet Copilot+ PC requirements. The Arrow Lake-S chips are already available, with the Bartlett Lake-S variants due to follow later this year. TIM DANTON

QUALCOMM SNAPDRAGON X

PRICE Not applicable • **AVAILABLE** Now

When I dropped in to see Qualcomm at CES, it was keen to point out that every single one of its Snapdragon X processors includes the same NPU. So, as a buyer, you know that you can take advantage of its AI abilities, whether that's mixing music or accelerating previously tough workloads such as background removal in photos (and they were impressive demos). This is in contrast to AMD and Intel, where you have to be very careful when selecting which chip you buy as many – including the new arrivals at CES – include NPUs that don't meet Microsoft's 40 TOPS criterion for Copilot+ PCs.

Naturally, Qualcomm's all-new Snapdragon X platform does, with the same 45 TOPS. Although calling it a platform right now feels over the top, as it consists of a single chip, the X1-26-100. This includes eight cores running at a peak of 3GHz, with a 30MB cache and an Adreno GPU rated at 1.7 TFLOPS. That compares to 12 cores, 4GHz, 42MB and 4.6 TFLOPS for its popular X1E-80-100 Elite chip, which reflects the fact that Qualcomm is targeting budget buyers who want Copilot+ PCs with its new chip. And not just laptops, with a handful of mini PCs (*see p31*) also featuring the X1-26-100. TIM DANTON

INTEL CORE ULTRA 200H, 200HX AND 200U

PRICE Not applicable • AVAILABLE Now

Intel announced its latest series of mobile processors at CES 2025, with the Ultra 200HX family targeting enthusiasts, Ultra 200H aimed at premium users and Ultra 200U meant for thin and light laptops. Unlike the 200V family, which use Lunar Lake architecture, the new chips are built off the same Arrow Lake architecture used in the current Core Ultra 200S desktop CPUs. Arrow Lake for desktop was rather underwhelming for gamers, but it makes sense for laptops due to its relative power efficiency, especially for everyday and professional workloads. The 200HX series covers six CPUs, from the 14-core (six P-cores, eight E-cores) Core Ultra 5 235HX to the 24-core (8P/16E) Core Ultra 9 285HX. The 200H series is a step down, ranging from the 12-core (4P/8E) Ultra 5 225H to the 14-core (6P/8E) Ultra 9 258H. The 200U series focuses on efficiency, with two P-cores and eight E-cores throughout the range.

Only the Core Ultra 200H series has Intel's top-end Arc graphics, with the HX and U series including the basic Intel Graphics GPU. This makes sense, as the 200HX series will likely be paired with a discrete GPU, leaving the integrated GPU for basic Windows use to save power. A number of new laptops include the H and HX series chips, but the 200U is likely to be found in cheaper machines – it's no match for the 200V series. JOHN LOEFFLER

AMD RYZEN PRO

PRICE Not applicable • AVAILABLE Now

One of Intel's biggest strongholds against AMD and Qualcomm is on commercial PCs, in part because of its long history in the sector but also due to the adoption of vPro – although AMD's general manager of its client business unit, Rahul Tikoo, told me at CES that he reckons only 5-10% of businesses actually activate the vPro technology they've invested in.

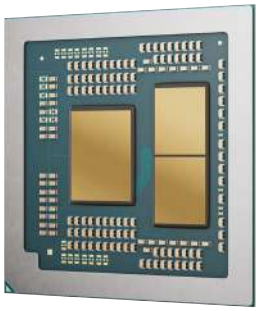
AMD launched its own out-of-band management system, Ryzen Pro, back in 2017, but it gained fresh momentum this year with almost all of its new mobile chips being launched with Ryzen Pro variants. "Intel has put a great marketing machinery around vPro and how important vPro is, but the reality is that Ryzen Pro does that and more," Tikoo said during our interview. "And companies can do exactly what they want to do in manageability or security or deployment of their products [with AMD] they can do with the other side." It's surely no coincidence that Dell's new fleet of commercial laptops support AMD for the first time. TIM DANTON

AMD RYZEN 9000HX

PRICE Not applicable • AVAILABLE H1 2025

"For the ultimate mobile gaming experience, new AMD Ryzen 9000HX Series processors deliver the most incredible performance a gaming laptop has ever seen." So gushed AMD's press release announcing its new graphics and gaming products at CES, and you can see why it's so bullish when you realise that its top release includes the V-Cache memory technology that many games love.

There are three chips in the range, but it's only the Ryzen 9 9955HX3D that includes this extra cache, bringing its total to 144MB. It also packs a handy 16 cores (32 threads), with a boost frequency of up to 5.4GHz. The Ryzen 9 9955HX has the same specs but only 80MB of cache, while the Ryzen 9 9850HX includes 12 cores, 24 threads, 76MB cache and boosts up 5.2GHz. Both will be great candidates for creator laptops, too.



The 9000HX range is based on Zen 5 cores, with a dual chiplet design, but there's no NPU. TIM DANTON

AMD RYZEN Z2

PRICE Not applicable • AVAILABLE Q1 2025

AMD's Ryzen Z2 series is helping to usher in the second generation of PC gaming handhelds in 2025 (*see p34*), with the promise of a step up in performance and efficiency compared to the Z1 series.

The Ryzen Z2 chips come in three tiers: Z2 Extreme, plain Z2 and Z2 Go. The Z2 Extreme features eight cores and 16 threads, a 5GHz boost clock, 24MB cache, 16 RDNA 3.5 GPU cores and a 15W-35W power envelope. The Z2 also features eight cores and 16 threads, but with a slightly higher 5.1GHz boost clock, the same 24MB cache, but 12 RDNA 3.5 GPU cores rather than 16, and a smaller 15W-30W power envelope. The all-new Ryzen Z2 Go (there's no equivalent in the Ryzen Z1 series) packs four cores and eight threads, a 4.3GHz boost clock and 10MB cache, but the same 12 GPU cores and 15W-30W power envelope as the Ryzen Z2. There's no hard release date as that depends on the handhelds, as detailed overleaf. JOHN LOEFFLER

INTEL CORE ULTRA 200V WITH VPRO

PRICE Not applicable • AVAILABLE Now

Intel's Core Ultra 200V ("Lunar Lake") series was the company's biggest silicon hit of 2024, and it doubled down on the technology by announcing vPro versions of the processors at CES. You only need to read through our list of best laptops to see how eagerly this move has been embraced by commercial laptop makers, and little wonder as the 200V series provides Qualcomm-rivalling battery life coupled with great performance – except in multitasking benchmarks. They meet Microsoft's 40 TOPS criterion for Copilot+ PCs, too. Intel also announced that it was making it far simpler for businesses (of all sizes) to roll out vPro technologies (see **tinyurl.com/366intelvpro**). Which makes sense, as vPro makes it possible to manage PCs and laptops remotely, which would have been a great help during the CrowdStrike fiasco last year. TIM DANTON

AMD RYZEN 9 9900X3D AND 9950X3D

PRICE & AVAILABILITY To be confirmed

AMD is finally replacing the Ryzen 9 7950X3D and Ryzen 9 7900X3D processors released in early 2023, while also offering a step up from the existing 8-core 9800X3D (*see issue 364, p58*). The 9900X3D features 12 cores, a 5.5GHz Boost clock and a 140MB L3 cache on a 120W TDP, while the 9950X3D packs 16 cores, a 5.7GHz Boost clock and a massive 144MB L3 cache on a meatier 170W TDP.

Unlike the 9800X3D, the new chips aren't strictly designed for gamers. The 9950X3D, especially, is being pushed as a creative processor on a par with the Core Ultra 9 285K and Core i9-14900K. Whether the new chips strike the right balance remains to be seen, but AMD is making promising claims. JOHN LOEFFLER

BEST HANDHELDS

NVIDIA GEFORCE NOW ON STEAM DECK

PRICE Free ● **AVAILABLE** Soon

If you own a Steam Deck, you probably already know you can apply a workaround to get GeForce Now on the handheld. Soon there will be no need for this fiddly hack, as official support is on its way.

Perhaps the biggest benefit won't be felt by those who primarily use the device for handheld gaming, but by those docking their Steam Deck with a full-blown display: you'll now be able to stream 4K at up to 60 frames per second using the Deck, provided you've got one of the punchily priced Ultimate tier accounts. The benefits will presumably extend to the SteamOS version of the Lenovo Legion Go (*see right*) and future SteamOS devices, too. BARRY COLLINS

LENOVO LEGION GO S

PRICE SteamOS from £500, Windows 11 from £600 ● **AVAILABLE** SteamOS May 2025, Windows 11 now

The Lenovo Legion Go S is the first of what's expected to be several third-party devices to license SteamOS, the Linux-based operating system Valve uses on its enormously popular Steam Deck handhelds.

There's a Windows 11 version too, which feels a bit like a sop to keep Microsoft sweet, although Lenovo appears to be making a pointed remark with its pricing. The base SteamOS version will be $100 cheaper than its Windows 11 equivalent, because the Windows version requires a bigger battery.

If your interests are purely gaming, there's little reason not to go for the SteamOS version. The selection of games isn't as broad, but most titles are compatible, and in our experience the lightweight, handheld-oriented OS is better for mobile devices than full-blown Windows. Its colour scheme is nicer too, in dark purple compared to the pure white Windows version.

The Go S has an 8in LCD display (sadly, not OLED) with a 1,920 x 1,200 resolution. It comes with up to an AMD Ryzen Z1 Extreme processor and Radeon 700M series graphics, and up to 32GB of RAM. If you can't wait to get your hands on one, there's a £650 Windows version on sale now, with a Ryzen Z2 Go. BARRY COLLINS

RAZER KISHI + PC REMOTE PLAY

PRICE Free beta ● **AVAILABLE** Now

Razer's Kishi controllers do a very presentable job of turning your smartphone into a gaming device, particularly if you use streaming services such as GeForce Now or Xbox streaming. Now Razer has hit on the idea of reviving in-home streaming, with the release of free software that lets you stream games from PC to phone across your home network, or even the open internet if you're brave enough.

Razer is positioning this software as an accompaniment to its latest controller, the Kishi Ultra, although it works with any Kishi or indeed any controller/phone combo. The company claims it's made it easier to launch games than rival apps, and that it auto-matches the phone's resolution on the PC, avoiding ugly black bars on the phone screen. BARRY COLLINS

ACER NITRO BLAZE 11

PRICE €1,199 ● **AVAILABLE** Q2 2025

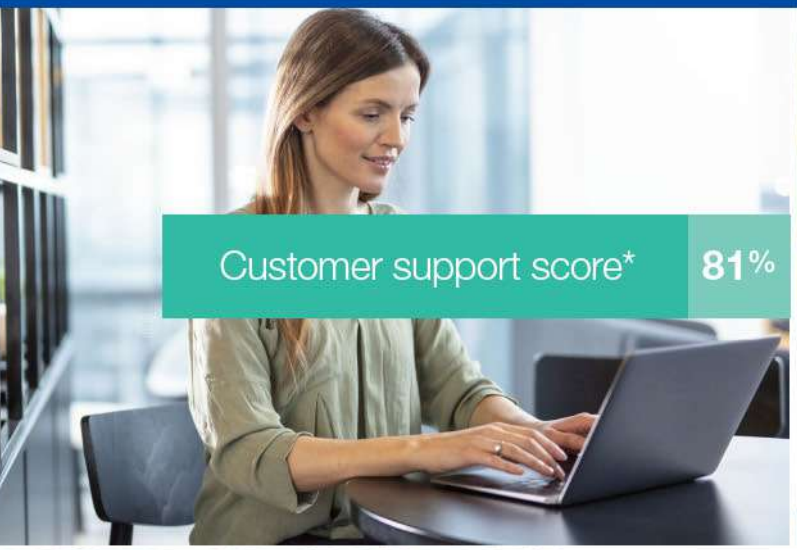
It's hard to describe just how massive the Acer Nitro Blaze 11 feels in the hand – it's not dissimilar to holding a dinner tray, albeit a very expensive one with cracking graphics.

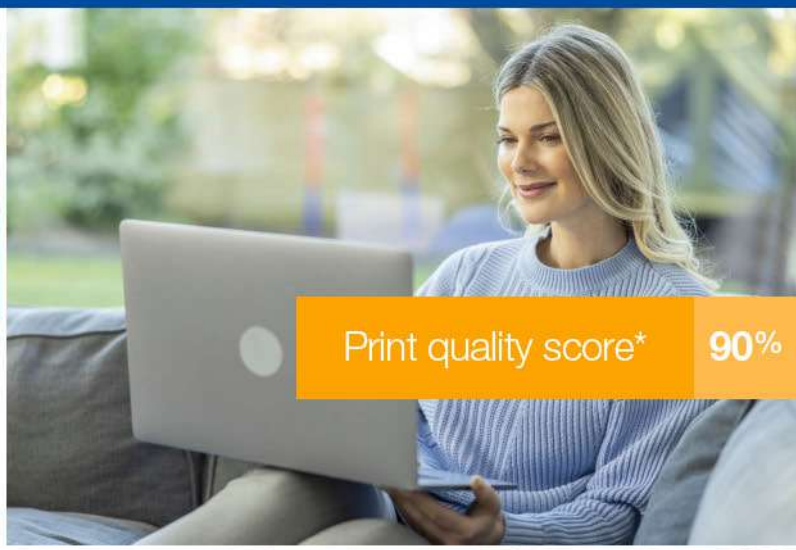
Well, we say cracking graphics. The spoilsports on Acer's CES stand didn't actually let us play games on the pre-production model that was on display at the show in case we wrote disparaging things about it, but the spec suggests this Windows-based handheld should deliver a decent wallop of gaming power. Its AMD Ryzen 7 8840HS processor, coupled with Radeon 780M graphics, shouldn't disappoint. It will come with up to 2TB of storage, although the 16GB of RAM is a touch on the tight side.

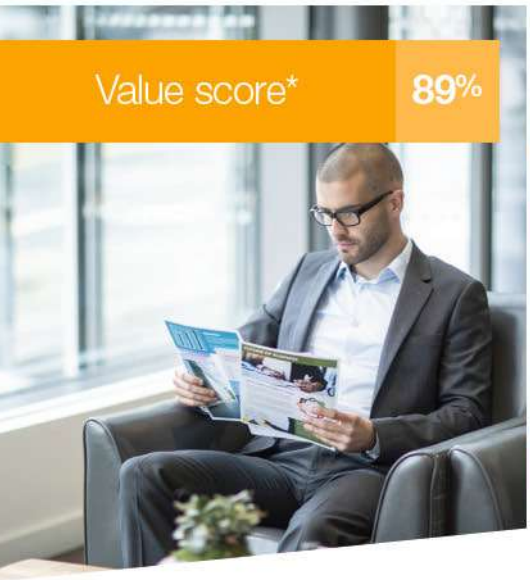
The controllers on each side of the display are detachable, but given how much room there is to play with on them, it's disappointing that Acer didn't see fit to include a touchpad for navigating the OS as well as gaming. Windows 11 has never been a pleasure to navigate with touch alone, even bearing in mind Microsoft's promise to redevelop the UI for gaming handhelds.

That extra screen space will certainly make it more pleasurable to play games with a cramped UI that are a struggle on regular handhelds, although Acer has an 8.8in version (€999) as well if you find the digital dinner tray too cumbersome. BARRY COLLINS

brother
at your side







PC PRO BEST PRINTER BRAND 2014-2024

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*As voted for by PC Pro readers in their 2024 survey.

BEST DISPLAYS

LG ULTRAGEAR OLED 45GX990A

PRICE & AVAILABILITY To be confirmed

The display industry can't make its mind up whether curved or flat screens are in fashion, so why should you? The LG UltraGear OLED 45GX990A offers both: at the press of a button on its remote control it goes from flat to a 900R curved screen.

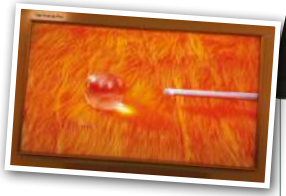
It isn't short of resolution, with 5,120 x 2,160 pixels spread across the 45in OLED panel. The LG Dual-Mode technology means it can switch between native 21:9 and 16:9 aspect ratios, with picture sizes of 27in, 34in or 39in.

It supports DisplayPort 2.1, HDMI 2.1 and USB-C with 90W power delivery, and is certified for Nvidia G-Sync and AMD FreeSync to keep everything looking smooth. A non-bendy version is launching at $1,999, so expect this to cruise past the $2,000 mark when it arrives later this year. BARRY COLLINS

SAMSUNG THE FRAME PRO

PRICE & AVAILABILITY To be confirmed

Samsung's The Frame concept is to give your TV a purpose in life beyond Netflix and the like, namely by displaying works of art. The Frame Pro ups the ante by introducing Mini LED technology to the range, giving the device stronger picture quality all round.



Samsung has worked hard on the aesthetics by making the controller box wireless, meaning you only need worry about keeping the power cord out of sight now. That controller box can be placed up to 10m away, Samsung claims, even with obstacles in its path.

The Frame Pro certainly looked punchy on Samsung's CES mega-stand; we'd expect the price to be equally eye-popping when it's finally launched. BARRY COLLINS

POCKETBOOK INKPOSTER

PRICE From $600 • AVAILABLE To be confirmed

If the idea of leaving a TV on to display wall art, like Samsung's The Frame, leaves you fearing for the polar bears (and so it should), the PocketBook InkPoster is a much more palatable alternative.

It needs to be charged only once a year, because this E Ink display – available in three sizes – displays art using the same sort of technology as your Kindle, needing no power to retain its image, only to refresh.

The colours and resolution of the images looked awesome on the CES showfloor, as good as high-quality prints, with the obvious advantage that the art can be refreshed. The 13.3in version will cost around $600, it's $1,750 for the 31.5in model and $2,400 for the 28.5in version, which has a different screen technology from Sharp. BARRY COLLINS

HP OMEN 32X

PRICE $749 • AVAILABLE April

The HP Omen 32x isn't just a gaming monitor as it packs Google TV. When you're not playing games, you can fire up Google TV and unwind with a selection of TV shows. No matter what's on the screen, everything looks gorgeous thanks to the sharp 4K resolution and smooth 144Hz refresh rate. It can even stream directly from four platforms, such as YouTube, if you want to show off your gameplay to others. You can do Android casting right from your phone, and deploy DeX Mode to get some work done. At $749, it's a relatively affordable gaming monitor that can serve multiple purposes. BARRY COLLINS

BEST ALL-IN-ONE PCs

HP OMNISTUDIO X NEXT-GEN AI PC

PRICE From £1,399 • AVAILABLE Now

What's most striking about the OmniStudio X is that it actually looks like a monitor rather than an all-in-one. Indeed, it can act as a monitor if you connect a laptop or PC. But its real skill is as an AI PC, based as it is around Intel's Core Ultra 200V processors, with support for up to 32GB of RAM and 2TB of storage. I was a little saddened to see that HP had abandoned the movable camera of its previous high-end all-in-one PC, but at this price – from £1,399 for the 27in version, £1,599 for 32in – I'm willing to concede the point. TIM DANTON

ACER ASPIRE S AI

PRICE From €1,299 • AVAILABLE Q2 2025

Acer launched two all-in-one PC ranges at CES: the C series, with a fixed stand, and the S series, shown here, which is finished in white and is a shade more expensive. Both are available in 24in and 27in variants and both meet Copilot+ PC requirements, with the S series using Intel's Core 200V chips and the C series relying on AMD's new Ryzen AI 300 chips. What marks the S series out is its touchscreen, along with support for Wi-Fi 7. HP wins the award for its greater versatility and (in my view) style, but it's a close-run battle. TIM DANTON

BEST ROBOTS

We think humanoid robots will be huge (well, about 5ft 8in) in 2025, but what we saw at CES 2025 was a mix of the fluffy, fearsome and worrying

ADAM

PRICE Price varies • **AVAILABLE** Available to rent in the US now

The robotic bartender ADAM uses AI to mix the perfect drink, say scientists at Richtech Robotics (**richtechrobotics.com**). It can be configured to make hot drinks like coffee and bubble tea, too, with an extensive library of drinks stored in its software. It also interacts with customers – according to company representatives – and provides recommendations. You can even rent ADAM... but right now, it's only available in the USA. KEUMARS AFIFI-SABET

REALBOTIX ARIA

PRICE $175,000 • **AVAILABLE** Now

"Let's get down to brass tacks," I say to Realbotix's CEO, on the company's tiny CES stand. "Is this a sex doll?"

"No," Andrew Kiguel replied, "but it can have, what I would say, conversations of a more intimate nature."

The conversation I'd want to have with Aria is: why do you cost so much? This $175,000 premium model, the apparent epitome of the company's goal to "create robots that are indistinguishable from humans", looks about as lifelike as Nelson's Column. Her limbs move like C-3PO having a stroke, her lips are badly out of sync with her speech, she moves around on a massive Roomba-like plinth. Even Captcha wouldn't bother asking Aria to prove she was human – she has less charm than a wheelie bin. Even calling Aria "she" is an offence against pronouns.

Still, if you get sick of looking at "her", you can rip her magnetic face off and replace it with another, maybe even one that looks like a celebrity or a historical figure. Don't ask how much that costs. Don't ask anything further. Just don't. BARRY COLLINS

BALLIE

PRICE To be confirmed • **AVAILABLE** Q2 2025

It's hard to believe that Ballie – the concept AI-powered robot that resembles a *Star Wars* droid – is already five years old. But the bright yellow, rolling smart home companion is finally getting released commercially this year,

Samsung representatives announced during a press conference at CES. Responding to "Hey, Ballie", the robot comes with plenty of sensors, a projector and AI designed to help you complete daily tasks, such as giving you directions. It also has a 2K camera on its rear and a 4K camera on the front. KEUMARS AFIFI-SABET

HAGAMOSPHERE

PRICE & AVAILABILITY Prototype only

Sitting on the line between drone and robot, the ominous-sounding (and looking) HAGAMOSphere packs eight propellers into a compact cubic frame and mounts them in a spherical chassis. This means the drone not only flies horizontally and vertically in any direction, but can also roll and rotate on the ground. Its Japanese creators (**hagamosphere.com**) hope to see it deployed in disaster-recovery scenarios in the future, including search and rescue due to its ability to dart into small gaps. KEUMARS AFIFI-SABET

MI-MO

PRICE $3,000 (mini), $30,000 (full-size) • **AVAILABLE** Late 2025

Disney lawyers may be in touch with Japanese developer Jizai (**jizai.ai**) after CES, with this Pixar-like lamp drawing crowds for its sheer cuteness. Jizai doesn't intend to sell this exact model, instead viewing itself as a hardware platform provider – it will release an SDK later this year and make Mi-Mo available for sale to developers. It's then up to third-party companies to create their own robots using its AI solution. Mi-Mo is there to give them hardware to play with right away, whether that's the full-size Mi-Mo on a multi-legged table or the mini version. TIM DANTON

MIRUMI

PRICE Around $70 • **AVAILABLE** Mid-2025

This adorable (or slightly unsettling) miniature robot clings onto your bag and interacts with people around you. Mirumi resembles a sloth and uses a built-in measurement unit and distance sensor to detect nearby people and then interacts with them by blinking its googly eyes and rotating its head. The somewhat less fluffy-sounding Yukai Engineering (**ux-xu.com**) said Murumi will be made available via a crowdfunding site (probably Kickstarter) in the middle of 2025. KEUMARS AFIFI-SABET

SENSEROBOT CHESS

PRICE $999 (pre-order) • **AVAILABLE** Due to ship September 2025

This AI-powered game-playing robot can help you master chess, with a 2-in-1 (chess and draughts) version also available. Its maker, SenseRobot (**senserobotchess.com**), is using **prelaunch.com** to raise funds to mass-produce its mobile game-playing robots for kids or even as a training partner for professionals. The chess robot's Apex Duel mode puts users up against an opponent with an Elo rating of up to 3,200, so higher than Magnus Carlsen (2,882) and Garry Kasparov (2,851) at their respective peaks. You can pre-order for $999 now via **tinyurl.com/366chess**. KEUMARS AFIFI-SABET

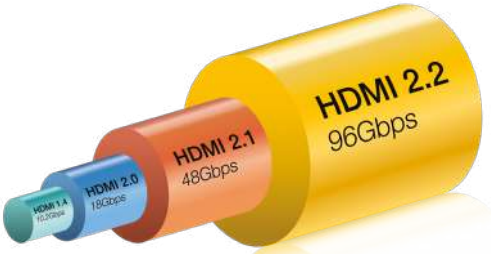
SWITCHBOT K20+ PRO

PRICE To be confirmed • **AVAILABLE** Late 2025

At first glance you could be forgiven for thinking this is just another robot vacuum cleaner, but popping out from its centre are robot appendages that enable it to do so much more. The SwitchBot K20+ Pro can perform multiple tasks in the home thanks to its robotic arm and finger grips, from real-time monitoring to cleaning up rubbish and delivering meals to acting as a mobile humidifier. And it's customisable through modules you can design yourself. The strangest release of CES? It's up there. KEUMARS AFIFI-SABET

BEST OF THE REST

There's never any shortage of weird and wonderful products on show at CES, with these simply the highlights from the deeper recesses of the event's many halls



HDMI 2.2

PRICE Not applicable • AVAILABLE Late 2025

The HDMI specification body used CES to announce HDMI 2.2, an upgrade on the current 2.1 version. As you would expect, it has lots of shiny new features – specifically around faster data rates and hence higher resolutions and frame rates.

You can share the 96Gbits/sec of data bandwidth between resolution and frame rate, so although HDMI 2.2 supports panels at 16K resolution, it can also do 4K at a 480Hz frame rate. There are new features in the specification for latency management, too, which will be handy.

All of which sounds great, but sales of 8K TVs are weak due to lack of content and high power consumption. It's hard to see a broader need for these new 2.2 capabilities, but doubtless vendors will try to sell them to us. And there will be a wait. The current version, HDMI 2.1, was announced back in 2017 but took years before it came to market in shipping TVs and gaming consoles. The same will happen with 2.2: initial product announcements later this year at the highest end of TV products, with more mainstream support coming in a few years' time. JON HONEYBALL

NVIDIA PROJECT DIGITS

PRICE & AVAILABILITY To be confirmed

Want a supercomputer on your desk for building AI engines? Nvidia has just the box: a small form factor unit with the GB10 Grace Blackwell Superchip inside. Along with 128GB of RAM, DIGITS can build and run models with 200 billion parameters. Once you've fine-tuned everything, the model can be deployed to the cloud or a data centre for operational use. At around £3K, this isn't a toy, but it is a computing monster designed for specific uses – and for those developers, the price will be immaterial. Availability is claimed for later this year and I'm sure the queue is already long. JON HONEYBALL

SWIPPITT

PRICE $450 + $125 for each battery Link • AVAILABLE June

If your house is anything like mine, it will normally have a teenager dangling off the sofa, holding a phone lashed to the wall, because it ran out of charge for the third time today.

Swippitt promises to end the ceaseless charging nightmare with a toaster-like device that contains five batteries. Pop your phone – wrapped in a special Link case – into the toaster (they call it a Hub), and two seconds later it pops back up with a fully charged battery installed. The company will sell Links for iPhones, Samsung Galaxy and Google Pixels to start with. It's not cheap, but if it works as well as it did in the demo, it's brilliantly convenient. BARRY COLLINS

Moana Wave T5

PRICE $100 • AVAILABLE From February

I hadn't heard of the brand Moana before stumbling across its stand in the Las Vegas Convention Center South Hall, but I'll definitely be watching out for new products from this audio specialist (in fact, we recorded the *PC Pro* podcast from the show using one of its desktop mics). In particular, I've asked the company to send me the Wave T5 set when it becomes available, as it's a hugely convenient pair of wireless Lavalier microphones with a range of up to 100 feet. Connect the USB-C adapter to your phone, clip mics to your presenters' lapels, and it's ready to work. With five hours of charge, and up to 20 hours via the box, it's a bargain at an expected $100. TIM DANTON

KEYCHRON K2 HE KEYBOARD

PRICE From $140 • AVAILABLE Now

The black version of the Keychron K2 HE has real Atari vibes: black plastic with a walnut veneer on the edges that gives it a retro charm.

The K2 HE uses the Gateron Double-Rail Magnetic Switch, which allows you to customise the actuation point and even assign multiple actions to a single key based on travel depth (in other words, tap lightly for one function, press harder for another).

I had only the briefest of hands-on plays on the Keychron stand, but it felt lovely under the fingers, and the keyboard has the reassuring heft that means even hammer-fisted typists won't shift it. BARRY COLLINS

EVEN REALITIES G1 AR GLASSES

PRICE From £594 • AVAILABLE Now

PC PRO BEST OF CES 2025

Most smart glasses I tried at CES were dire. Even Realities shows promise, however, with a clever optical waveguide to bring the text panel into the centre of your field of view – much like the HUD in a car. It has a useful window size and crisp text. And best of all, it's shipping now. It tethers to an app on your phone, which provides direction information (not when driving), AI-based translation, quick notes, reminders and a teleprompter mode. Starting from just under £600, this is not a cheap plaything, but you can order prescription lenses and varifocals. What I saw – mostly a text display projected into my line of sight – was head and shoulders above the competition, but it will live and die by the app. JON HONEYBALL

RAZER PROJECT ARIELLE

PRICE $1,000+ • AVAILABLE Prototype only

Face facts, gamers: you can get awfully sweaty when trying to take down the teenagers in

TCL NXTPAPER 11 PLUS

PRICE & AVAILABILITY To be confirmed

It's becoming increasingly difficult to tell Android tablets apart from each other, but buy the TCL Nxtpaper 11 Plus and you'll have no such problem. It uses TCL's new Nxtpaper 4.0 technology for rich colours when you want them, but press a button on the side and it transforms into an E Ink-like black and white. You can choose a focus mode, too, to hide attention-sucking apps and quieten notifications. But this 11.5in tablet isn't a one-trick pony, with AI tools to help you write, plus Google's Circle to Search – and the latter will work with your finger or the optional T-Pen. I only had a limited time with the tablet on the CES showfloor, but it's well made, sleek and extremely light. My only complaint is that TCL is keeping schtum on the specifications, price and release date, merely saying it will go on sale "this year". TIM DANTON

Counter-Strike. And we do mean awfully.

Razer's prototype chair is fitted with air conditioning to combat this, blowing cold air around the seat when you're overheating or warm gusts if the home office is a little chilly on a February morning.

It's surprisingly effective, too. Razer's crowded CES suite was hotter than the sun, crammed with high-end gaming gear and staff who looked like they'd lost a stone demonstrating it. But when I was plonked in the chair with the cooling fans switched on, it was a glorious moment of respite... before they demonstrated the heaters and I wanted to run out of the room and dive into The Venetian's fake canals.

It's currently only a prototype, Razer insists, but it didn't half look like a finished product. Don't be surprised if it actually launches this year. BARRY COLLINS

TARGET OMNI AUTO SCORING SYSTEM

PRICE £450 ● AVAILABLE Now

If Luke Littler's heroics have you digging your dartboard out of the garage, here's an add-on to bring darts screaming into the 21st century.

The Omni Auto Scoring System is a plastic ring you mount around any dartboard. It contains LED lights and four HD cameras that can detect where each arrow has landed, even bounce-outs. That integrates with an Android/Apple app that allows you to keep score of local games, play against opponents online, and keep track of your stats. Note that the app costs extra after a three-month trial. BARRY COLLINS

TP-LINK DECO BE65-OUTDOOR

PRICE & AVAILABILITY To be confirmed

What the world has surely been waiting for: Wi-Fi 7 in your garden. Because this IP65-rated tri-band mesh node can be added to any TP-Link mesh Wi-Fi system to extend your network by 3,000 square feet. If your home is wired for Ethernet, you can power and add the Deco BE65-Outdoor to your network using a single cable. With a combined top speed of 11Gbits/sec, you can download or stream just about anything to any one of 200 connected devices. ANTHONY SPADAFORA

WITHINGS OMNIA

PRICE & AVAILABILITY To be confirmed

The Withings Omnia is an AI-powered mirror that gives you a full health assessment as well as showing your reflection. Along with data pulled in from other Withings gadgets, a base in the stand measures your weight, heart rate, blood pressure and metabolic health. Withings says it will also be able to run ECG scans and check for signs of atrial fibrillation.

You should be able to use the Omnia mirror to get feedback on the quality of your sleep, workout recovery and VO2 max monitoring. The mirror will display stats on screen, and give relevant feedback via an AI assistant. You might see a recommendation to book a check-up with the doctor, or to fit more active minutes into your day. In true AI chatbot fashion, you'll be able to ask questions about your health and get answers in return. For now, this is still in development, so there's no news on a price or a launch date. DAVID NIELD

JON HONEYBALL'S HOT TAKE ON CES 2025

A visit to CES is always worth the time, effort and cost, because you'll see an entire planet's worth of IT thinking, dreaming and sheer desperation laid out in front of you

This year, the world was clearly, if slowly, moving from the "AI with everything" we saw last year. Then, AI felt like a slap-on marketing tag, but many firms are making real progress in justifying the moniker.

The one big winner, of course, is Nvidia. A new range of graphics cards promises multiplier levels of speed increases. Although some accuse the company of "cheating" by using inferred frames to bump up the frame rate, it's hard to argue when you see the demos.

For me, though, Nvidia's Project DIGITS was the high point of CES 2025. Although it isn't yet a shipping item, it promises to bring true supercomputer levels of AI performance at a petaflop of speed to the desktop of any researcher or AI fiddler, for a cost close to a serious desktop PC. This will allow those who have the data sets and who want to build AI models, but don't want to splurge on paying cloud services, to build these models on local hardware. And then, owing to the strength of the Nvidia software and deployment platform, to roll these out at scale via cloud services if required. This is uncharted territory, but it will be fascinating to see how DIGITS is used. I predict a strong presence in healthcare diagnostics, as one example.

Wearable screens were another big topic, although most that I saw fell towards the "truly miserable" end of the scale. But a few were showing proper waveguide solutions that projected data into your line of vision, in a manner akin to a heads-up display in a car. Clearly there's a huge amount of work required to be done here to get a wearable AR product that is actually useful on a day-to-day basis, but many bright minds are working on it. By contrast, there were few demonstrations of solutions based on the Apple Vision Pro, but this wasn't surprising because of the per-user guest setup requirements. But quite a few companies had software to share via Apple's development platform code-sharing test environment, which I will follow up.

Healthcare, especially with lashings of AI overtones, was another big topic, although no-one has yet managed to create the Holy Grail of blood sugar monitoring done optically through the skin. Samsung boldly talked about whole-person health monitoring and AI-generated personal modelling, but this was really just arm waving around existing tech and the newly announced partnership with Continuous Glucose Monitoring (CGM) manufacturer Libre. And it was interesting to see vendors in the CGM space such as Dexcom announcing over-the-counter non-prescription CGM devices, to allow those who might be health-conscious or pre-diabetic to get a handle on their sugar processing.

Finally, I saw a big push towards making assistants look and feel like another human, both in the cloud and locally generated. I'm not sure this will be the right direction, and the "humanification" might be a dead end. Much is being done on seamless additional help that simply bolts on to your existing life – a tool that immediately and seamless converts between speech between two different languages doesn't need a talking head to make it work well. But this requires a bolder and more interesting approach, and it will be interesting to see who wins and loses when we return in a year's time for CES 2026. ●

Be more productive with focus sessions

Tame distractions and get things done: Nik Rawlinson takes a close look at focus features in Windows and other platforms

It's been said that the obstacles in our path aren't what stop us achieving great things; rather, it's the easier paths we choose to follow instead.

Nowhere is this truer than when sitting at a computer. You could be getting on with writing your novel, but half an hour clicking around the web is easier and more beguiling. You could have finished filing your taxes – if you'd not been distracted by your email. You might even have got ahead on an academic assignment, if you hadn't spent the time compiling the perfect playlist. Each of these paths is a distraction, and while we're sympathetic to anyone who finds themselves continually distracted by an ever-connected PC, there really is no excuse for such behaviour today – not if you're using Windows.

That's because the latest versions of Windows 10 and 11 include a feature called Focus Sessions to help you shut out distractions. When a focus session is active, alerts and notifications are disabled, and the computer tracks how long you've been working so far and how long you still have to go, so you don't need to worry about burnout. Let's take a look at how focus sessions can help you in daily life – and how you can take advantage of similar features when working on other platforms.

Setting up your sessions

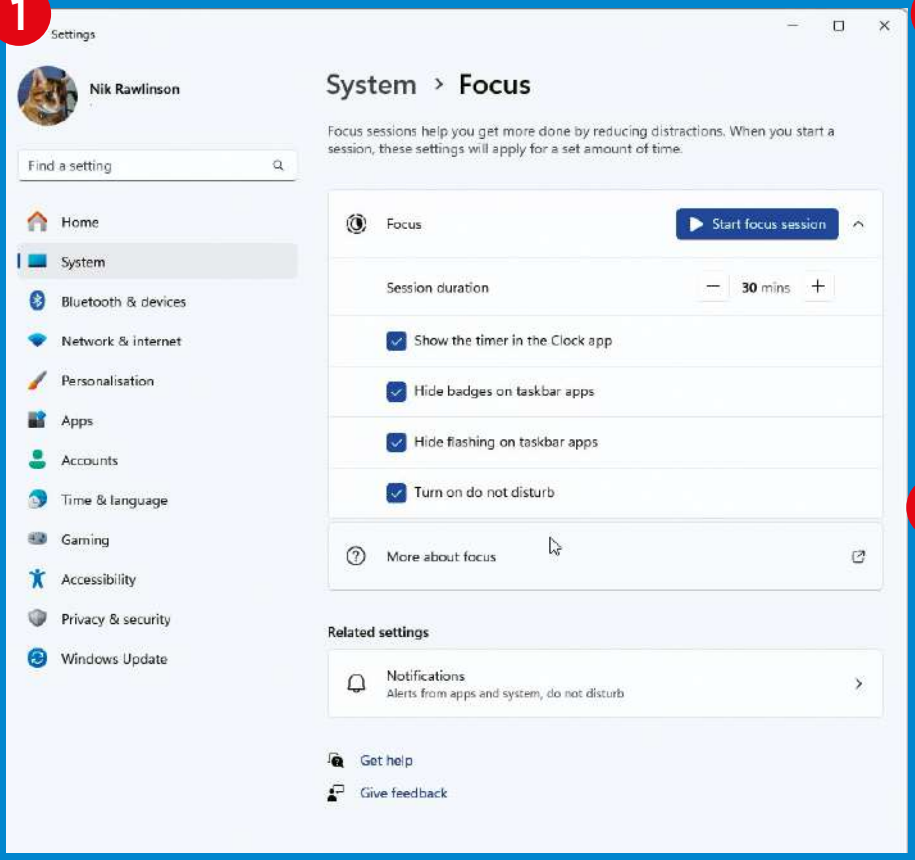
Before you start focusing, you'll want to set up some parameters. Unhelpfully, the relevant settings are split between the Clock app and the wider system settings, so you'll need to visit both to fully tailor Windows to your requirements.

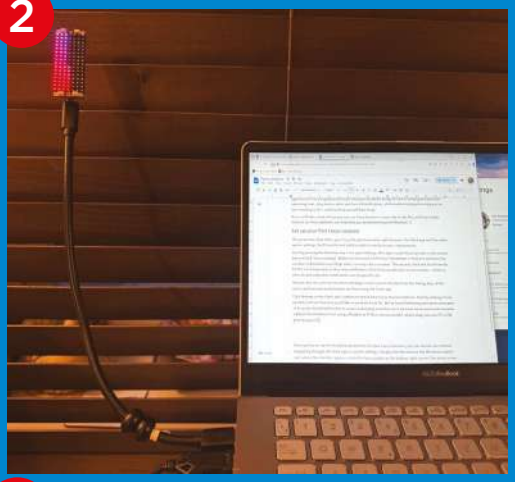
Start by opening the Settings app (press Windows+I), then type "focus" into the Search box and click on "Focus settings". You'll see four tickboxes that let you decide how Windows will behave while in focus mode, and we recommend you ensure that they're all ticked to minimise distractions. The second, third and fourth are by far the most important as they stop notifications from drawing attention to themselves – which is otherwise precisely what they're designed to do.

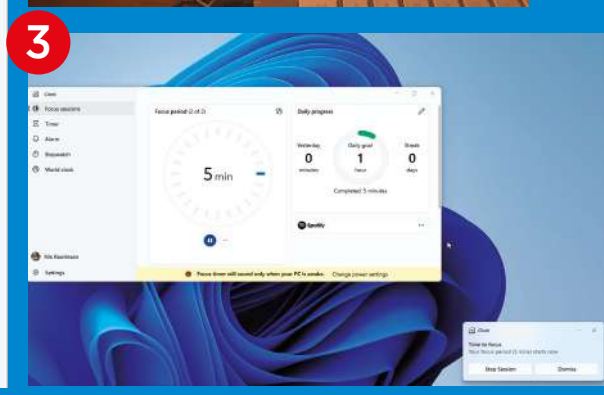
Now launch the Clock app and click Settings in the sidebar to tweak your focus session options. Start by clicking "Focus periods" and set how long you'd like to focus and rest for. Be clear that a focus session isn't the same as a working day: a focus period is the amount of time you intend to spend working on a task without interruption before taking a break, so while you might be tempted to set this to eight hours, that's not realistic (or desirable). The lengths you set here for your focus and rest periods will apply across all of your Focus Sessions (unless you return to this screen and change them), and you can chain together as many of them as you like within your available working time.

We've found the Pomodoro technique works well when it comes to keeping ourselves on track: this involves 25-minute work sessions punctuated by five-minute breaks, with a longer break after four sessions. You can't fully replicate this in Windows, but you can set your focus period to 25 minutes and your break period to five minutes, and then remind yourself to take a longer break after two hours. Alternatively, there are plenty of

A focus period is the time you intend to spend working on a task without interruption







other tools you can use: we've built a physical Pomodoro timer using a Raspberry Pi Pico microcontroller, which plugs into our PC's USB port for power, providing an always-on reminder of our work cycle in the corner of our eye.

The remaining focus session settings are to do with sound. By default, Windows plays a chime at the end of a focus or break period, but you can click the headers to try out different sounds for each. You can also choose to have Spotify play non-intrusive background music during focus periods, by connecting your Spotify account to the Clock app. This feature doesn't work with rival music streaming services, but it's compatible with free Spotify accounts, so you don't need to pay to use it.

Running your first session

Once you're happy with your settings, click "Focus session" at the top of the sidebar in the Clock app to return to the main session page, and use the "get ready to focus" dialogue to set the total length of time you want to work – including breaks. The app will work out for you how many focus sessions and breaks you'll have during that period: so, for example, if you're starting work at quarter past nine and lunch is at one o'clock, you can set a work time of 225 minutes. If you've set your focus sessions to be 25 minutes apiece and each break to run for five minutes, Focus Sessions will give you seven work sessions for a total of 175 minutes, with one further work session of 15 minutes, and seven five-minute rest sessions between them.

All this might seem fiddly, but once you've set up the parameters for your Focus Sessions, Windows will remember them, and you can launch one at any time with just a few clicks. Simply click the time on the Windows taskbar, then, when the calendar appears, click the Focus button in the bottom-right corner to start a new session using your existing settings.

Managing your schedule

Focus sessions can help you get things done, but it's also important to have a clear idea of what you want to achieve during each session. For many people, a simple list can be a vital productivity tool, helping to manage task priorities and ensure nothing gets missed. A good to-do list doesn't only show the jobs you have to do, however, but gives them some context: for example, some jobs can only be performed in a certain location, and others at a specified time, either because you'll be in the right head space to tackle them, or because someone with whom you need to collaborate will also be available.

1 Use the Settings app to suppress notifications while you're focusing

2 We built this real-world Pomodoro timer using a Raspberry Pi Pico

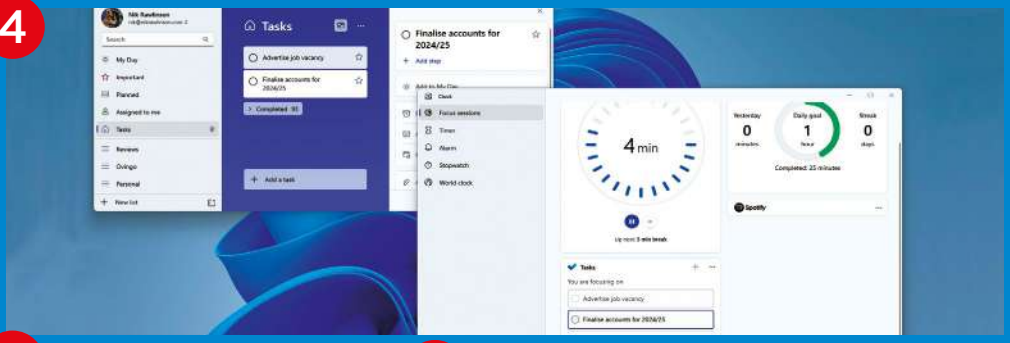
3 Focus Sessions will alert you at the start of each focus or rest period

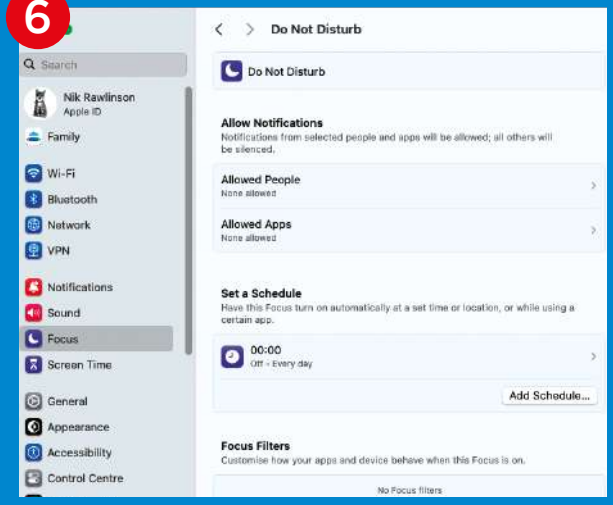
To help with this, you can integrate the Microsoft To-Do app with Focus Sessions, so the jobs you plan there appear in the Clock app. Likewise, any jobs you add via the Focus Sessions panel in Clock will be synchronised to To-Do. As well as living on your main PC, these tasks will appear in the To-Do app for Android and iOS, so you'll have them to hand wherever you happen to be.

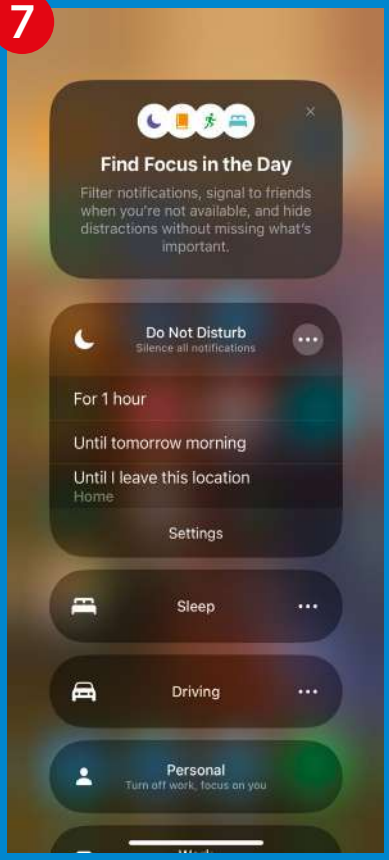
Once a job appears on your list, you can assign it to your current focus session by hovering over it and clicking the "Select for this session" link. There's one notable limitation here, though: you can only select one task to focus on at a time, to keep you on track, and if you complete a task before the session is over, you can't directly select another one – you'll need to pause the session, make your selection, then resume.

Focusing on Apple devices

Windows isn't the only operating system with built-in tools to help you







stay focused. Focus Mode was introduced in macOS in 2021, bringing its own distraction-limiting features to the Mac desktop. To enable it, click the Control Centre icon to the left of the clock, followed by Focus. By default you'll see three focus options: driving, sleeping and Do Not Disturb. You can configure each mode differently according to how far you want to lock down your interruptions, and you can also add new focus profiles of your own.

It might seem strange that there's an option for driving; this appears because your status can be synchronised across all devices logged into the same Apple ID. Selecting driving here before leaving the office will also enable it on your iPhone, so you won't be disturbed while behind the wheel.

When you're sitting in front of your Mac you'll normally want to use the regular Do Not Disturb profile. You can turn this on for an hour or until the next morning by selecting the appropriate option from the menu; alternatively, clicking the Do Not Disturb header will leave it turned on until you switch it off.

To customise what happens when your Mac and other devices are in focus mode, click "Focus Settings..." at the bottom of the menu to open them in System Settings, then click the Focus profile you want to edit.

In the image above, we're editing the Do Not Disturb setting, to make it automatically activate according to a schedule (useful for blocking out regular meeting times), while making exceptions for specific apps and contacts that are allowed to interrupt the session. To do this, click Allowed People, then click the "+" button to select which calls and messages will be allowed through. By default, anyone who calls you twice within three minutes will also be allowed to interrupt, even if they don't appear on your list of approved contacts; if you don't like this idea, turn off the "Allow repeated calls" option in the Allowed People dialog.

Focus Mode was introduced in 2021, bringing its distraction-limiting features to the Mac desktop

4 Clock and Microsoft To-Do can be used to synchronise your jobs list

5 You'll find macOS's focus settings in the Control Centre

6 You can specify what's allowed to happen when Focus Mode is active

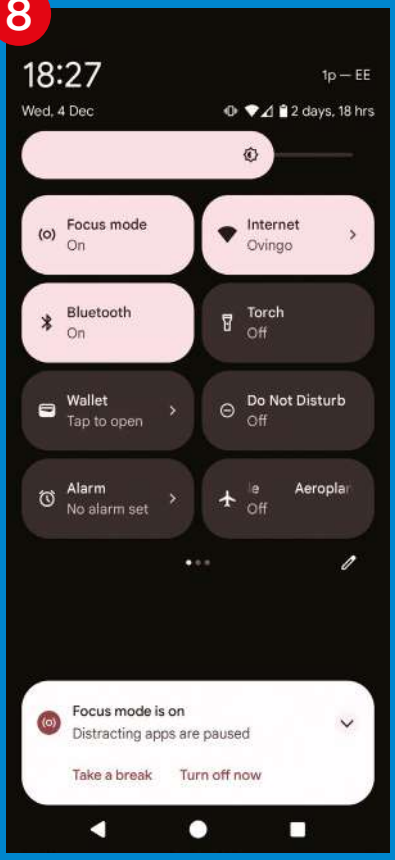
7 iOS has additional Focus Mode profiles

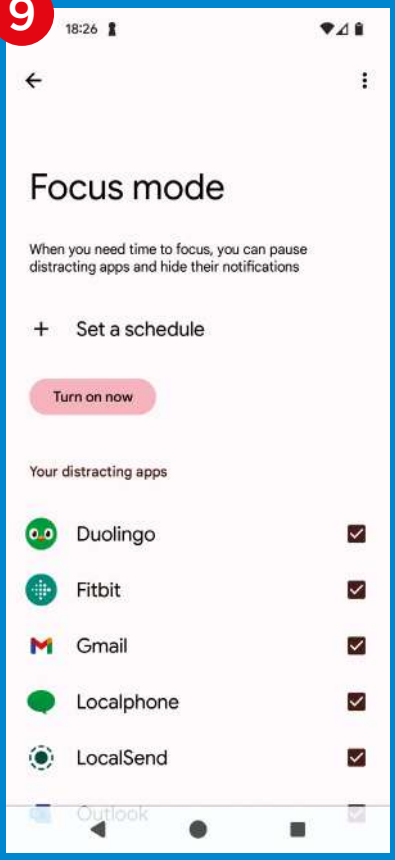
To turn on Focus Mode on an Apple mobile device, swipe down from the clock to open Control Centre, then tap Focus, followed by the focus profile you want to use. You may see a more diverse range of profiles on offer here than on your Mac, and two of them – Personal and Work – won't be fully set up at first. Tap either one and you'll be switched to the Focus area in the iOS or iPadOS Settings app to customise it to your liking.

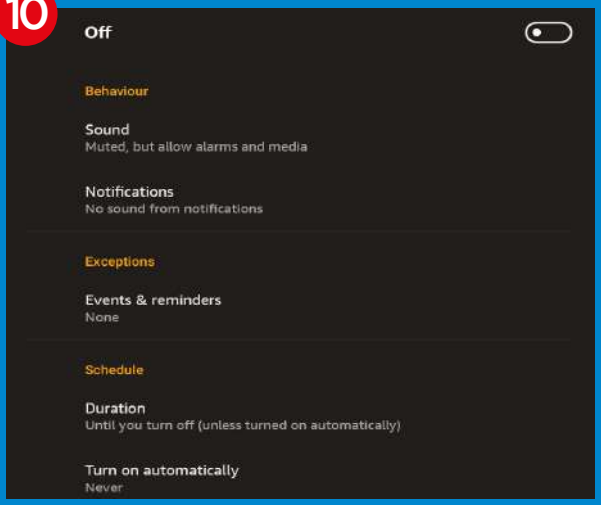
Staying focused on Android

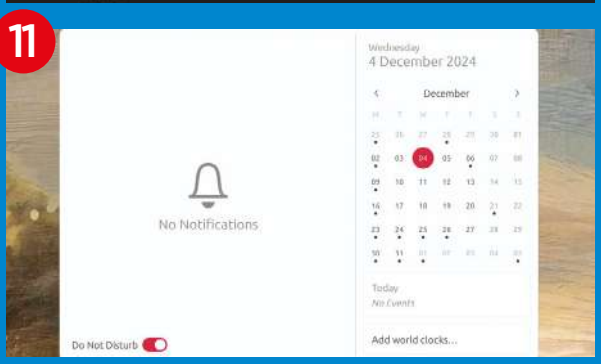
Android supports a wide range of focus features, though different manufacturers may implement them in different ways. If you have a Google Pixel 3 or later, turning over the phone and placing it face-down on your desk instantly turns on Do Not Disturb; you can also swipe down from the top of the screen to find a quick-access Do Not Disturb button.

What you might not see, unless you've enabled it, is the Focus button that's part of Android's digital wellbeing tools. If this doesn't appear on your phone, tap the pencil to edit the buttons on









the panel, then scroll through the list and tap "Focus mode".

When you first activate Focus mode you'll be prompted to specify which apps you want to be silenced when the mode is activated. Tap "Select distracting apps" to expand the menu, then tap the tickbox beside any app you want to turn off while you're trying to focus.

You can then either select "Turn on now" to enable Focus mode immediately, or set a schedule to block out distractions at specified times.

You can tweak the list of blocked apps whenever you choose, but once it's set up you won't normally need to adjust it. From now on, tapping the Focus mode button on the menu that appears when you pull down from the clock will apply the settings you've already defined.

If your Android device doesn't include digital health tools, you may be able to customise its Do Not Disturb mode. Amazon's Kindle Fire tablet, for example, offers extensive Do Not Disturb options in the Settings app's Sound group. This allows you to tweak not only your audible alerts, but visual notifications, exceptions for reminders or events, how long a session lasts, and whether it should kick automatically on a preset schedule.

When it comes to Linux there are even more variables than on Android

Staying focused on Ubuntu

When it comes to Linux there are even more variables than on Android, but many distributions include some way to reduce or block distractions. Ubuntu works with several window managers, but the default Gnome desktop has an easy-access do-not-disturb mode that you can use for focusing. To find it, click the clock and you'll see a switch at the bottom of the notifications dialog. When this is turned on, a struck-through bell icon appears beside the clock.

8 You can add a Focus mode button to Android's shortcuts

9 Specify which apps can't notify you when in Focus mode

10 You'll find extensive Do Not Disturb settings on Amazon's Fire OS tablet devices

11 To turn off distractions in Ubuntu, click the switch at the bottom of the notifications panel

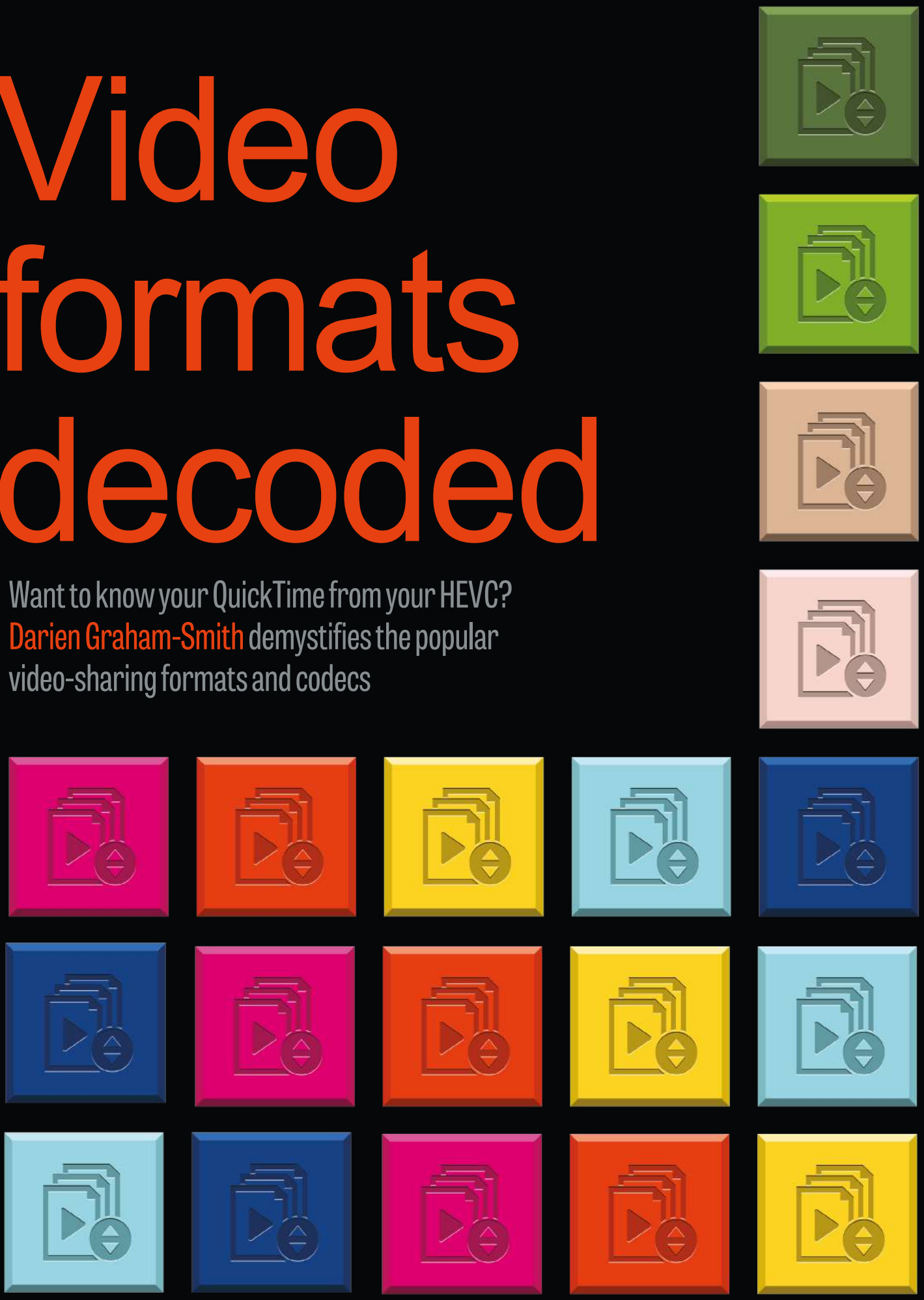
The mainstream Linux variants don't come with a full equivalent to Focus Sessions, but you can use a third-party app such as Pomodoro for Gnome (**gnomepomodoro.org**) to time your work sessions. Its implementation is a faithful translation of the original technique – it comes set up to run for four 25-minute sessions with three five-minute breaks, then an extended break of 15 minutes before the cycle repeats.

Bells chime at the start of each session and you can optionally set it to make a ticking sound. You might imagine this would be a distraction, but the original kitchen timer used to devise the Pomodoro technique almost certainly ticked, and anecdotally we've found that the repetitive sound helps to keep us focused – as well as blocking out some background noise. Perhaps the most important aspect of the timer is that it can be set to suppress notifications, much like Focus Sessions in Windows.

If you're not using Gnome – or if you just don't want to install a dedicated timer application – you could also try a web-based timer, such as the one at **focusplus.io**. This can't block notifications or distractions, so you'll need to partner it with some self-discipline, but it can't be beaten for convenience.

Video formats decoded

Want to know your QuickTime from your HEVC? Darien Graham-Smith demystifies the popular video-sharing formats and codecs



While capturing and editing video is easier than ever, the fighting file formats are a pit of complexity. We're asked to choose between AVI, MP4, H.264 and so forth, but what's the difference between them?

Here's everything you need to know to produce the best videos for your needs, whether you're looking for smaller files, fast transcodes or the best possible quality.

The big picture

The fundamental reason why all these different formats exist is that each frame of video – in the form that we see on our screens – is huge. A single frame of Full HD video consists of 1,920 x 1,080 pixels, which is to say just over two megapixels. If each pixel were represented by a single bit, the full frame would represent over two megabits (that is, 250 kilobytes) of raw data.

And of course we don't use one-bit video, as that would mean each pixel would only be either black or white. Most mainstream media uses a 24-bit colour palette, with eight bits representing each of the red, green and blue components for a palette of 16,777,216 colour tones. This allows for subtle colour gradients and shades that look (to the human eye) perfectly smooth, with no blocky aliasing. It also pushes up the raw size of the frame to 1,920 × 1,080 × 24 for a total of 49,766,400 bits. In other words, just under 50 megabits, or around 6.2 megabytes.

Then of course we need to think of the time domain. A typical Hollywood film will be shot at 24 frames per second, so one second of footage represents 49,766,400 × 24 bits for a total of 1,194,393,600 bits. That's equivalent to around 150 megabytes per second, so a two-hour film equates to more than a terabyte of data. This is an inconveniently large amount of information to be working with. And that's before we consider HDR media, which typically uses ten bits of colour data per pixel, or higher frame-rate media, shot at 30fps or even 60fps. 4K media is four times the pixels – and hey, you might like to include some sound with that video, too?

It's clear that, for us to be able to edit, share and store video data on our personal devices, it needs to be compressed down to a manageable size – and this is where all the different file formats come in.

Containers and codecs

Let's start by clearing up a common point of confusion. The file formats we commonly refer to as "video files" actually carry two types of information: the video itself and the accompanying audio content. Aside from the fact that these elements are intended to be played simultaneously, they're quite independent of each other, and are encoded and stored separately inside what's called a container file.

In fact, container files often contain more than two data streams. For example, there might be multiple selectable audio streams for 5.1 or DTS playback, or even a separate stream for embedded commentary. Metadata such as subtitles and chapter divisions can be stored in the container file, too.

Many different container formats have been developed over the years. Older ones include Audio Video Interleave (AVI), Matroska video (MKV), WebM (WEBM), Microsoft's Windows Media Video format (WMV) and the Third-Generation Partnership Project (3GP) format, designed for sharing videos over 3G mobile networks. Now, though, the industry has settled on two standard container formats: MPEG-4 (M4V or MP4) and QuickTime File Format (MOV). All current video-encoding and playback applications will support at least one of these formats, so unless you're working with archive footage you can forget about the rest.

The file formats we refer to as "video files" actually carry two types of information: the video itself and the audio content

ABOVE As detail increases, the size of the raw video data becomes huge

The container format is only half of the equation, however. The other question is what compression system has been used for the data streams inside. Audio content almost invariably uses Advanced Audio Coding (AAC) compression, but there have been dozens of different systems developed over the years for encoding and decoding video data ("codecs", for short), MP3 being the most famous. Thankfully, again, only a few of them are in widespread use today.

All the mainstream video codecs are "lossy", meaning they trade off file size for fidelity, but they're also all fully configurable, so the person exporting the video file can decide whether to create a large file with very high-quality content or trade off fidelity for a smaller file size. At the point of encoding they can also scale the original video data to their desired resolution, and choose how many bits to use for colour data.

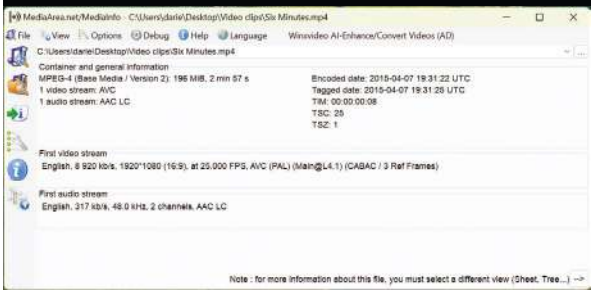
These numerous decisions determine the eventual bit rate of the file – that is, how many bits of data are stored for each second of video. Although a low bit rate generally corresponds to low overall quality, different codecs can produce differing results, and it's also possible to use slower, more computationally expensive encoding methods to pack more detail into a given number of

What's in the container?

If you're curious about the make-up of a particular video file, there are plenty of tools you can use to look inside its container. One free, open-source choice is called MediaInfo (tinyurl.com/366mediainfo).

You can use MediaInfo by dragging any video file into the application window, or right-clicking on a video file in Windows File Explorer and selecting "MediaInfo" from the contextual menu.

You'll now see a "Basic" view, showing a breakdown of all the data items contained in the file. Under "First video stream" you'll see the specified language of the primary video file, along with its bit rate, resolution, frame rate and compression format; below, similar information is shown for the first audio stream. For more details, open the "View" menu and select "Sheet" or "Tree" to browse embedded metadata and other details of the file.


MediaArea.net/MediaInfo - C:\Users\dario\Desktop\Video clips\Six Minutes.mp4
File View Options Debug Help Language
Container and general information
MPEG-4 (Base Media / Version 2): 196 MiB, 2 min 57 s
1 video stream: AVC
1 audio stream: AAC LC
First video stream
English, 8 920 kb/s, 1920*1080 (16:9), at 25.000 FPS, AVC (PAL) (Main@L4.1) (CABAC / 3 Ref Frames)
First audio stream
English, 317 kb/s, 48.0 kHz, 2 channels, AAC LC

bits. The upshot is that the use of a particular container format, and even a particular codec, doesn't necessarily tell you much about the quality or resolution of a video file.

Which video format should I use?

If you've ever shot your own videos, edited existing footage or re-encoded old files to save space, you may have wondered which file format is best for your output. As we've seen, it doesn't matter which container format you use, as long as you choose one that's supported by your target platform or application. In fact, beginner-friendly video apps such as Microsoft Clipchamp may only support a single output format – typically either MOV or MP4, since these are by far the most widely used file types. You won't go wrong if you stick to one of these industry-standard formats, as all the major sharing platforms will accept them, including Facebook, Instagram, TikTok, Vimeo and YouTube.

Depending on the software you're using, you may also be able to choose between codecs, the most common being H.264, H.265 (also known as HEVC) and Apple's high-quality ProRes encoder, which comes under its QuickTime branding. These codecs each have their own strengths and parameters, as we'll discuss below.

If you have the option to choose a frame rate, it normally makes sense to match the frame rate of your source footage, as converting it will slow down the export process and could make the video look jerky. Clipchamp and Apple's iMovie always use 30fps, which is the default for most smartphones and digital cameras, but you might sometimes want to mix in some 60fps footage, or insert clips from commercial videos that play at different rates. In this case you'll need to let the software downsample or upsample these clips as needed, so the whole file plays at a consistent frame rate. It is technically possible to create video files where the frame rate changes from scene to scene, but these aren't widely supported by playback platforms.

A final consideration is output resolution. The size of a video file grows rapidly as you increase the resolution – as does the amount of time taken to encode it. So if you just want to quickly share a selfie video on social media, you might choose to use 480p or 720p, and reserve higher resolutions for more cinematic creations. Nowadays it's generally assumed that any video file, regardless of the resolution, will be in a 16:9 aspect ratio, but you can still use the older 4:3 format if you prefer, or a wider shape; the player will either resize to fit your footage, or play it with black bars along the sides or the top and bottom.

The different codecs

So, back to the central question: if you have a choice of codecs, which should you use, and which settings should you apply? There are numerous legacy codecs floating around that programs still support, such as CinePak, DivX, MJPEG and RealVideo. There are also a few open-source options, such as AV1 and VP9. For modern standards of quality and compatibility, however, there are only three codecs you need to know about.

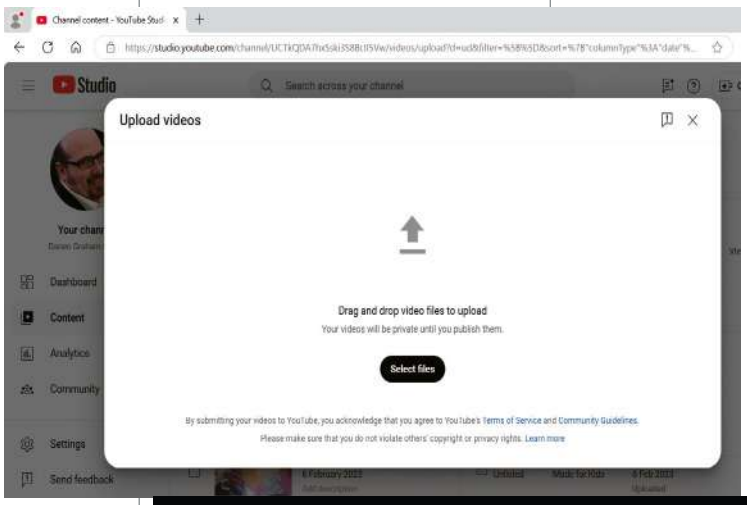
H.264 – also known as Advanced Video Coding, or AVC for short – is the industry standard for distributing video. It's been around since 2004, when it was chosen as a default codec for Blu-ray discs; it's now widely used by streaming services and shows no sign of becoming obsolete any time soon. The latest revisions support resolutions up to 8K, with 14-bit colour and frame rates of up to 600fps. H.264 achieves high-quality results at reasonable bit rates by using techniques such as compressing data based on the content of previous frames as well as the current one, and only encoding parts of the image that are changing from frame to frame.

Then there's **H.265**, which, as the name suggests, was designed as a successor to H.264. Introduced in 2013, it's also known as High-Efficiency Video Coding, or just HEVC, because of its ability to produce video files of similar quality to H.264 at around half the file size – or twice the quality for a given file size. It achieves this by using similar compression techniques, but with greater flexibility to break the image up into differently sized segments, and to compress each segment with the most efficient method available. It also introduces better ways of detecting and encoding elements that move from frame to frame.

H.265 is natively supported by all major desktop and mobile operating systems, so from a consumer's point of view it's all upside. However, H.265 encoding can take as much as 20 times as long as H.264, which is one reason why many creators stick with the older standard.

Apple's **ProRes** codec takes a different approach to H.264 and H.265. Aimed at professionals, ProRes prioritises image quality above all else – some have gone so far as to call it "visually lossless". It also doesn't use inter-frame compression, meaning that each frame can be decoded independently, making it ideal for non-linear editing or scrubbing. These design decisions make ProRes files very large: one minute of SDR ProRes video at 1080p, running at 25fps, takes up around 1.6GB of storage. Clearly this isn't a good format for sharing or streaming, but it can be useful for storage, archival and editing.

None of these "big three" codecs is technically free. H.264 and H.265 are protected by various patents, but you don't need to pay to encode or watch video in these formats – at least not directly – as licences are covered by the suppliers of the software and services that use them. Similarly, Apple's ProRes format must be licensed for use in both software and hardware, but you won't normally need to worry about this as the company offers free codec support for both macOS and Windows.

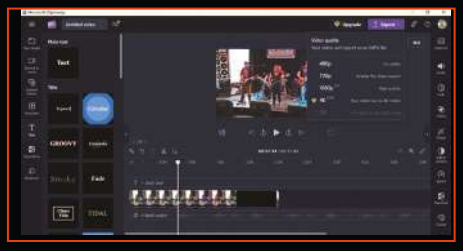


BELOW All major video-sharing services will accept MOV and MP4 files

> The use of a particular container format doesn't necessarily tell you much about the quality or resolution of a video file

Get the best from free video apps

Microsoft Clipchamp



As we've noted, Clipchamp produces MP4 files using the H.264 codec at 30fps; if your source footage is in another format, it will be converted automatically when you import it. The exception is if your video is less than 15 seconds long, in which case you can export as an animated GIF.

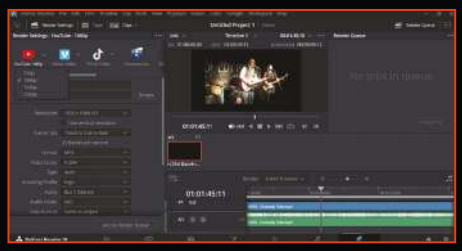
Once you've made your edits, the "Export" button at the top-right of the main Clipchamp window brings up a dropdown letting you choose what resolution you want to export at. There are no user-selectable quality or compression settings: once you've picked a resolution, the encoding will start immediately, and you'll be given a choice of export locations including OneDrive, Google Drive, YouTube and TikTok.

Apple iMovie

iMovie's "Share File" dialog lets you export at 540p, 720p or 1080p resolutions – although if your project doesn't include any Full HD video, that last option will be greyed out. The Low, Medium and High quality presets all use H.264 compression, with different trade-offs of quality and file size. If you select Best (ProRes), iMovie will use Apple's professional-quality codec instead, resulting in an output file that looks excellent but is around six times the size of one produced with the High quality preset.

The dialog provides a handy dynamic estimate of how large your output file will be with currently selected settings. There's no estimate of how long it will take to render, but once you've started an export you can click in the circle icon in the top-right of the application window to see an estimate of time remaining, and cancel it with the "x" icon if you don't want to wait that long.

DaVinci Resolve

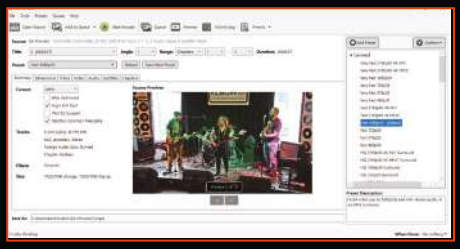


We explored DaVinci Resolve in issue 365 – you can download it for free from **blackmagicdesign.com** – and its "Deliver" module offers handy export presets for YouTube, Vimeo, TikTok and other services. They all default to a resolution of 1080p, but you can click the arrow next to them to switch to 720p, 1440p or 2160p (4K).

Below this, the Format dropdown lets you choose from a wide range of container types, including not just MP4 and QuickTime but also AVI, MKV and the professional MXF format. You can explore the codec options too, to try out H.265 and other compression types.

Don't overlook the Encoding Profile dropdown either, as this lets you choose different compression levels. The "Base" profile is for low-bandwidth targets such as mobile phones, while "Main" and "High" provide normal and top-quality output. When you're happy with your settings, click "Add to Render Queue", then click "Render Queue" at the top-right of the Deliver window to start processing.

Handbrake



The free Handbrake video-conversion tool **(handbrake.fr)** offers a huge range of options for transcoding video files, but you can get started easily by clicking the "Presets" button in the top toolbar. This opens a sidebar showing an extensive list of container and codec options. The "General" profiles support different resolutions and frame rates to suit almost any need.

Most of these presets use H.264, but you can easily switch to a different codec by selecting your preset, then clicking on the "Video" tab in the main window and selecting H.265 or another codec from the dropdown menu. You can also change the desired frame rate here – potentially useful if you want to use one of the "Web Creator" presets, as these all default to 60fps.

Handbrake's other tabs include options to resample or crop the video to change its resolution, convert the audio, apply various filters and update the metadata. Once you hit the "Start Encode" button a progress display appears along the bottom of the window, including an estimated time to completion.

BELOW Professional editors use the Apple ProRes codec to keep as much detail as possible

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Acer Swift 14 AI (Intel)

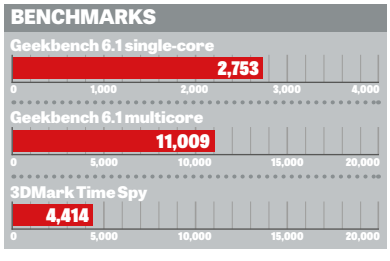
Not the greatest multitasker, but long battery life, thin design and a good-quality screen lift its appeal

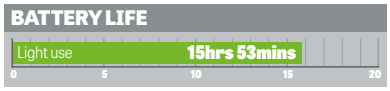
SCORE ★★★★☆

PRICE Core Ultra 7 258V, £1,083 (£1,300 inc VAT) **from** store.acer.com

The Acer Swift 14 AI Intel is a Copilot+ laptop with several top features. It's speedy, with graphics that can actually handle games; its battery lasts two regular workdays; its OLED display pops with colour; and it's superbly portable. As the name suggests, there's also a generous helping of AI horsepower under the bonnet.

The model I tried features a Core Ultra 7 258V processor, a 1TB SSD and 32GB of RAM; there's also a cheaper variant with a Core Ultra 7 256V CPU and 16GB of RAM, along with 16in variants of both (one of which I review overleaf). Note that while 16GB of RAM is enough for most purposes, the memory is soldered to the motherboard so can't be upgraded.





Sleek design

The Swift AI 14 is thin and light, measuring 16mm thick and weighing 1.3kg – light enough to comfortably hold one-handed. A lovely dark, metallic-looking finish keeps the chassis from looking bland; Acer calls it Steam Blue, although depending on the lighting I'd say it looks black or light grey. The small Acer logo etched into the lid becomes a prism when it reflects light, and I spent a happy minute tilting it back and forth, watching the pretty colours glide across the logo. The screen doesn't fold around into pseudo-tablet mode, but it will open out to a full 180°.

The vents on the underside help with the sleek look of the laptop, and leave space for a good-sized keyboard and trackpad. The keys span almost the entire laptop width, and the trackpad is almost 5in wide; it's not the smoothest I've used, but my fingers never skipped over the surface or caught on it. It's accurate and responsive too, and pressing down registers a full, satisfying click. However, sometimes it misunderstood my gestures: I had to place two fingers all the way on the left side if I wanted to scroll through a web page or document, and occasionally when I wanted to tap to place the cursor in the middle of a sentence, it scrolled to the top or the end of the page instead.

I didn't love the keyboard: the keys feel slightly muddy when most typists prefer a snappy response.

ABOVE Acer's Swift 14 AI is a well-designed laptop with excellent battery life

"The display has a sharp resolution of 2,880 x 1,800 and a refresh rate of 90Hz, and you can expect deep blacks and vivid colours"

BELOW The laptop's metallic-looking finish gives it a classy look

Audio visual

The display is a 14in non-touch OLED screen, with a sharp resolution of 2,880 x 1,800 and a refresh rate of 90Hz. Those are strong stats, and you can expect deep blacks and vivid colours. My only warning here is that it's a glossy display, meaning glare could be a problem if you want to work (or play) in a brightly lit environment.

Above the screen sits a very good 1440p webcam. Whether I was using it under

fluorescent or natural light, I was impressed by the colour and detail it picked up; I could even make out a few flyaway strands of hair. It works better with cool lighting sources than warm ones, though: when I had my Ikea Tärnaby table lamp turned on at the same time as the laptop screen, the webcam overcompensated for the lamp's warm lighting and cast a bluish tone over my face. When you don't want to be seen, there's a physical shutter to close off any possibility of unwanted access.

Audio performance is surprisingly strong, too. The Acer Swift 14 AI's speakers provide plenty of volume and heavy bass; Rob Zombie's "Dragula" is one of my go-to songs for laptop testing, because most laptop speakers drain the chorus of aggressive fun, but the Acer's bottom-firing speakers do a robust job with it – so long as the laptop is placed on a flat surface.

Speed vs efficiency

When it comes to performance, the Intel Core Ultra 7 258V is a multifaceted beast. "Lunar Lake" introduced major architectural changes, which altered the balance between single-core and multicore performance. In particular, the 200V series chips don't support Hyper-Threading, so the eight cores (already fewer than previous generations) don't double into 16 threads.

This has an interesting impact in benchmarks. In the single-core Geekbench 6 test, the Swift 14 AI scored an excellent 2,753, making it 20% faster than the LG gram SuperSlim 15.6in (*see issue 364, p51*) with its last-generation Core Ultra 7 155H (2,285). It even outpaced the Asus Vivobook S15 (powered by a Snapdragon X Elite X1E-78-100) by 12%, with a score of 2,432.

In the multicore benchmark, however, the Swift 14 AI scored only 11,009 – behind the LG (11,455) and around 25% slower than the Asus Vivobook (14,522).

Still, this doesn't mean a huge amount in real-world use. Occasionally the laptop felt sluggish when I had multiple active tabs in Edge and was running Spotify, Word, Slack and Discord at the same time. But for regular desktop tasks it's a very responsive chip.

And the big advantage of Intel's approach – which prioritises efficiency over raw speed – is battery life. The Swift AI 14 Intel is one of the longest-lasting laptops we've tested, surviving 15hrs 53mins on a full charge. In use, I found this was enough to get me through a busy two-day trip without having to plug in once.

BELOW Both the keyboard and trackpad are a decent size

Gaming juice

Intel's integrated Arc graphics perform well. In 3DMark Time Spy the Swift AI 14 scored 4,414, which is higher than other laptops we've tested with a Core Ultra 7 258V, which typically return around 4,200. That's a huge jump over laptops with the Core Ultra 7 155H, too (the LG SuperSlim returned 3,433), and a full 35% ahead of the Arm-powered Asus Vivobook, which scored 1,907.

That carries over to real game engines: in the *Sid Meier's Civilization VI: Gathering Storm* benchmark, the Swift AI 14 Intel averaged a smooth 61fps at 1080p and Medium visual settings. It fared well in more demanding games, too, averaging 29fps in *Shadow of the Tomb Raider* with Ultra graphics at 1080p; you can edge close to 60fps if you turn down the settings.

BELOW Although it can't be used in tablet mode, the screen does fold out to a full 180°

While running all these tests, the laptop never got hot. The warmest point I measured on the surface was above the F8 button on the keyboard, which peaked at 28°C. The underside didn't exceed 24°C, so I could work with this laptop sitting on my lap.

AI smarts

As the name of this laptop implies, the Core Ultra 258V also packs plenty of AI capabilities. The Intel NPU is rated for 48 TOPS, contributing to a total of 120 TOPS for the whole system once the GPU gets in on the act. This is partly used to power Microsoft's Copilot+ PC features, such as Windows Studio Effects, Live Captions and Recall; Intel's AI Playground is available to download, too.

Acer also offers its own AcerSense AI portal, which serves as a gateway to custom features such as AI-generated desktop art, image editing and the Acer Assist helper, which searches your files without sending any data to the cloud. None of these features transformed my working day, but there's plenty of power and potential for the laptop's AI functions to grow with future updates.

"For anyone seeking a versatile and portable Windows laptop the Acer Swift 14 AI is an attractive option"

Big deal

I'm less keen on the bundled software and apps that come preinstalled: these include AppExplorer, Booking.com, a Dropbox promotion, an Xbox Game Pass promotion, Acer LiveArt, two separate DTS sound applications, Intel Unison (another take on Windows Phone Link) and ExpressVPN.

Despite that fly-tipping, for anyone seeking a versatile and portable Windows laptop the Swift 14 AI is an attractive option. Heavy multitaskers should consider the Arm version, which we hope to review next month, especially as its battery is likely to last even longer; however, that model's a fraction heavier and thicker than the Intel version, and also comes with less RAM. As an all-round productivity laptop, the Acer Swift 14 AI Intel has more than ample performance and battery life, and enough NPU power to handle current and future AI workloads. **JOANNA NELIUS**

SPECIFICATIONS

8-core (4 P-cores, 4 E-cores) Intel Core Ultra 7 processor 258V ● Intel Arc 140V graphics ● 32GB LPDDR5X-8533 RAM ● 14in 90Hz non-touch OLED, 2,880 x 1,800 resolution ● 1TB M.2 PCI-E Gen4 SSD ● Wi-Fi 7 ● Bluetooth 5.4 ● 1440p IR webcam ● 2 x Thunderbolt 4/USB-C 4 ● 2 x USB-A 3.2 Gen 1 ● HDMI 2.1 ● 3.5mm combo jack ● 65Wh battery ● Windows 11 Home ● 312 x 221 x 16mm (WDH) ● 1.3kg ● 1yr RTB warranty ● part code NX.J2KEK.006

Acer Swift 16 AI (Intel)

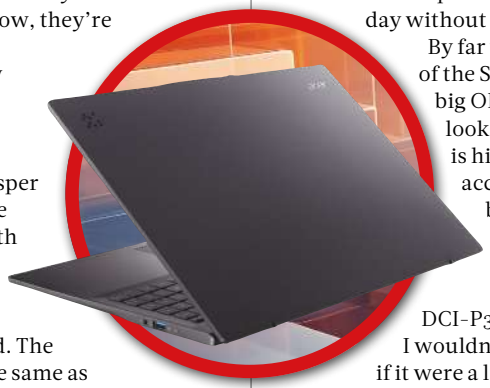
The 16in OLED panel and speakers are real strengths, making this an attractive choice for the price

SCORE ★★★★☆

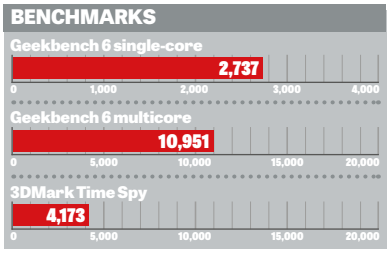
PRICE Core Ultra 5 226V, £1,000 (£1,200 inc VAT) **from** store.acer.com

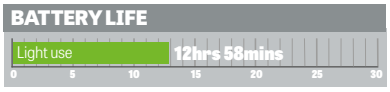
The 16in model of Acer's Swift AI laptop is, on paper, all but identical to the 14in model (*see p48*) – only bigger. It's still sharp-looking and deliciously thin, tapering from 15.9mm at the back down to 9.9mm at the front.

There are differences, though. Naturally, it's a little heavier, at 1.5kg – enough to make the squared-off edges feel a little uncomfortable when you hold the laptop in your hands. On the plus side, the extra space allows Acer to squeeze in a numeric keypad alongside the main keyboard, and while the number keys are distinctly narrow, they're usable. I was also pleasantly surprised to find that the keyboard response is crisper than that of the Swift 14 AI, with a nice action and a deep but quiet clacking sound. The touchpad is the same as the one on the smaller model, although the larger chassis makes it feel less generously sized.



As well as not upscaling the trackpad, Acer hasn't built any additional ports into the Swift 16. The four USB connectors are useful, but I'd have liked to see an Ethernet port or a microSD slot. Curiously, the webcam across the top bezel lacks the privacy shutter of the 14in version.





Although Acer's website claims that its Swift AI laptops can offer up to 29 hours of battery life, I didn't get anywhere near that in our battery rundown test – mine died after 12hrs 57mins of continuous use. That's still not bad: in real life the laptop easily got me through a full day of work, comprising eight hours of writing and emailing, grading essays and getting distracted by cat videos on YouTube. Just don't expect a full second day without a charger.

By far the best feature of the Swift 16 AI is its big OLED display. It looks amazing, and is highly colour accurate with a brilliantly wide gamut – I measured 139% of the DCI-P3 colour space. I wouldn't have minded if it were a little brighter, though: the peak of 384cd/m² is fine for indoors, but is susceptible to glare on sunny days.

Perhaps the second-best feature is the Swift's bottom-firing speakers. They're no replacement for a decent pair of headphones or external speakers, but they sound way better than I expected, with just enough bass in my playlist of metal and industrial songs to make me lightly headbang. Together with the screen they make this a very enjoyable multimedia laptop.

The Swift 16 AI model I tried features an Intel Core Ultra 5 226V processor and 16GB of RAM; there's also an option with the Ultra 7 CPU and 32GB of RAM, priced at £1,500 inc VAT. Either way, the performance profile is similar – that is, great for single-core jobs, but mediocre at multitasking.

ABOVE The Swift 16 AI's OLED screen is a real highlight

PC PRO RECOMMENDED

> **"By far the best feature of the Swift 16 AI is its big OLED display. It looks amazing, and is highly colour accurate"**

LEFT The laptop tapers down to a slim 9.9mm at the front

BELOW The keyboard has a nice action and a deep but quiet clacking sound

The Swift 16 AI's multicore Geekbench score of 10,951 is well behind 16in rivals such as the AMD-powered Asus Zenbook S 16 (*see issue 361, p52*), which topped 13,000.

Still, there's enough performance for typical use, and the integrated Arc graphics can handle demanding games. Set to 1080p and Medium visual settings, the Swift 16 AI averaged 50fps in the *Sid Meier's Civilization VI: Gathering Storm* benchmark, which feels perfectly smooth in practice.

Intel's chips also include a powerful NPU, and since the Swift 16 AI is an official Copilot+ PC it's in line to get all of Microsoft's latest and future AI features, such as Cocreator in Paint, Restyle Image, Click to Do and Recall. At the time of my testing, Microsoft's Copilot AI companion was the only AI feature on general release, but I had fun chatting to it, and it's good to know that it will work even offline.

On the Acer side, you get the AcerSense system control tool, along with Acer's suite of AI assistant software. As on the 14in version, you also get a disappointing amount of bloatware for unrelated services such as Booking.com and Dropbox; if you don't want these apps cluttering your new laptop you'll need to clear them off manually.

For most people the Swift 14 AI might be a more sensible choice; the 16in version is heavier, with less exceptional battery life, and doesn't bring any advantages in terms of connectivity or multitasking performance. But if you're looking for a big-screen laptop that's thin and AI-capable, the Swift 16 AI's vivid display, great speakers and even its keyboard make it a pleasure to use from day to day. **JOANNA NELIUS**

SPECIFICATIONS

8-core Intel Core Ultra 5 226V processor • Intel Arc 140V graphics • 16GB LPDDR5X-8533 RAM • 16in 90Hz OLED touchscreen, 2,880 x 1,800 resolution • 1TB M.2 PCI-E Gen4 SSD • Wi-Fi 7 • Bluetooth 5.4 • 1440p IR webcam • 2 x Thunderbolt 4/USB-C 4 • 2 x USB-A 3.2 Gen 1 • HDMI 2.1 • 3.5mm combo jack • 65Wh battery • Windows 11 Home • 356 x 249 x 16mm (WDH) • 1.5kg • 1yr RTB warranty • part code NX.J3ZEK.002

Acer Swift Go 14 AI (Qualcomm)

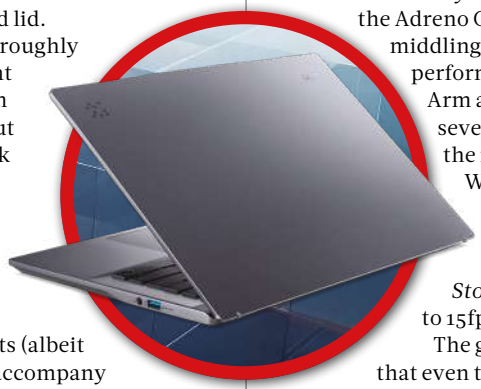
Excellent battery life and a colourful 14.5in screen can't hide all the sacrifices Acer has made to hit a price

SCORE ★★★☆☆

PRICE £741 (£890 inc VAT)
from johnlewis.com

Acer's Swift Go series sits a rung or two below the Acer Swift range, so don't expect the same build quality or aesthetics. It features a grey aluminium lid that looks like a standard film prop laptop; it's blank outside of the Acer logo in the top right and Acer's AI branding in the top left. Still, basic looks aside, it has that premium metal feel thanks to a sandblasted lid.

At 1.4kg it's roughly the same weight as most modern 14in laptops, but at 16.6mm thick it's a fraction chunkier than rivals. But Acer rewards you with plenty of ports: two USB-A ports (albeit 5Gbits/sec) to accompany the pair of USB-C 4 ports, plus an HDMI 2.1 connector and the expected 3.5mm combo jack.



There's no Thunderbolt, but that isn't a surprise when you consider the Qualcomm Snapdragon chip inside. This is the budget "Plus" X1P-42-100 chip, with eight cores rather than the ten or 12 of its Elite siblings, and that's reflected in relatively modest scores in our benchmarks. Where the Honor MagicBook Art (*see p52*) returned 2,820 and 14,521 in Geekbench's single-core and multicore tests, the Acer scored 2,426 and 11,379. I also noticed sluggish performance in my hands-on tests, with Chrome tabs taking longer to load than normal and even delays in File Explorer.

Hopefully you're not thinking about buying the Acer Swift Go 14 AI for its gaming capabilities, as it doesn't have any. Not only does the Adreno GPU offer middling graphics performance, but the Arm architecture severely limits the number of Windows games you can use. In *Civilization VI: Gathering Storm*, it stuttered to 15fps at 1080p.

The good news is that even though this is a low-level Qualcomm chip, it still includes the same NPU as the rest of the series. That means acceleration in a growing number of applications, particularly creative ones, and also means you can enjoy the various Copilot+ PC features – Windows Studio Effects, Live Captions and very soon the controversial Recall. Like all Acer AI-branded laptops, you can tell when the NPU is called into action thanks to an indicator on the touchpad.

Another Qualcomm advantage rapidly – or slowly – became clear in our light-use battery life tests, where the Acer Swift Go 14 AI kept going for a superb 16hrs 10mins. That gives it bragging rights over the Core Ultra 258V-powered Acer Swift 14 AI (*see p48*), albeit by only a few minutes.

That battery life was with a 14.5in IPS panel with a 2,560 x 1,600 resolution, but UK residents are only being offered the 1,920 x 1,200 version. That means slightly longer battery life, but a drop in sharpness; across a 14.5in diagonal the higher-resolution display would certainly have been preferable. This also means we don't have quality results for the panel, but if it's along the same lines as the tested display (and it probably will be), then expect bold and accurate colours but not much brightness. My sample peaked at 331cd/m².

ABOVE The screen produces punchy colours with a speedy 120Hz refresh rate

"Hopefully you're not thinking about buying the Acer Swift Go 14 AI for its gaming capabilities, as it doesn't have any"

LEFT The uninspiring grey lid looks plain, but is sturdy enough

BELOW When the NPU is working, the icon on the touchpad lights up

The keyboard also shows signs of cost-cutting. The keys don't offer that satisfying bounce, so I found myself hitting with more force than usual. Travel is limited, too. And the generously sized touchpad would have been a dream to use, thanks to a smooth surface, were it not for an unsatisfying "click" that went deeper on the left side of the chassis than the right.

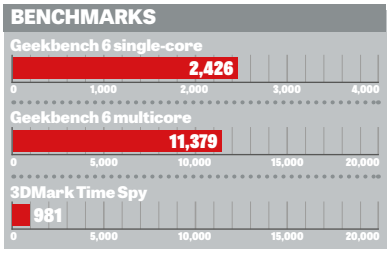
Like its sibling, the Acer Swift Go 14 AI includes a 1440p webcam that produces plenty of detail and well-balanced contrast, but here it suffers from a faint green hue. Acer supplements Windows Studio Effects with its AI-powered PurifiedView feature, which sharpens the image, but I can live without these. The side-firing speakers are similarly mixed, with loud and crisp vocals but barely present bass. Don't get excited by the promise of "DTS:X" tuned speakers, as the settings are limited.

All of which means that it's hard to recommend the Swift Go 14 AI, despite its aggressive price for a Copilot+ PC. Yes, it includes a bold display, excellent battery life and a 1TB SSD, but there are too many compromises to hit a price. **RAMI TABARI**

SPECIFICATIONS

8-core Qualcomm Snapdragon Plus X1P 42 100 SoC • Qualcomm Adreno graphics • 16GB LPDDR5X-7467 RAM • 14.5in 120Hz non-touch IPS panel, 1,920 x 1,200 resolution • 1TB M.2 PCI-E Gen4 SSD • Wi-Fi 7 • Bluetooth 5.4 • 1440p IR webcam • 2 x USB-C 4 • 2 x USB-A 3.2 Gen 1 • HDMI 2.1 • 3.5mm combo jack • 75Wh battery • Windows 11 Home • 323 x 226 x 16.6mm (WDH) • 1.4kg • 1yr RTB warranty • part code NX.KYXEK.003

BENCHMARKS



BATTERY LIFE

Honor MagicBook Art 14 (Qualcomm)

An innovative camera setup marks out this slim and speedy laptop – if only it was on sale in the UK

SCORE ★★★★½

PRICE €1,417 (€1,700 inc VAT)
from honor.com/fr

Fancy a trip to France? Right now that's the easiest way to buy the Honor MagicBook Art 14 Snapdragon, as the laptop is only on sale there, China, the UAE and Saudi Arabia. Honor is monitoring sales in France before it decides whether to sell it in the UK, so a 4.9-star rating on Honor's French site is a promising sign.

Start using the MagicBook and it's easy to see why it's so loved. The screen is a 14.6in expanse of OLED beauty with a super-sharp 3,120 x 2,080 resolution. It's almost perfectly tuned to the DCI-P3 gamut, too, with 97% coverage out of a 98% volume. Add a peak brightness of 486cd/m² and crisp whites, plus solid colour accuracy (an average Delta E of 1.36), and you have a great panel.

Honor amplifies the screen's effect by including slim bezels on all sides, and that includes the top bezel. That's because there's no webcam to squeeze in, with Honor instead including a magnetic, detachable 1080p webcam that's housed in the left of the chassis. When you want to use it, press on the edge and it bounces out, at which point a light appears at the top of the display to show you where to clip it. The magnets then snap it solidly into place. It's all very slick, not to mention privacy-friendly, and it can even point backwards.

There are two downsides, however. First, sometimes Windows lost the connection to the camera despite it being attached. This is probably a driver issue, as it's early days for this technology. Also, the camera's quality can't match that of recent laptops, with good colours but a lack of detail. I even checked for a protective coating that I needed to unpeel, as I expected a crisper image.

The mics picked up my voice clearly, however, and I was even more impressed by the MagicBook's speakers. They deliver subtle details many laptop speakers miss, and pack bass thanks to four extra units to accompany the two tweeters.

Speaker grilles sit either side of the keyboard, but there's still space for full-sized keys. These have a crisp feel thanks to a solid backplate, so I was happy typing on it, but Honor could learn a lesson from Lenovo on cushioning. It instead lavishes its attention on the huge "Magic" trackpad, which includes special gestures – scrolling up and down the left and right adjusts screen brightness and volume, for instance, while tapping the top left of the pad minimises the active window.

Honor talks up the cooling, but I rarely heard the fans kick in. That's to be expected from a Snapdragon laptop, even with a powerful 12-core X Elite chip inside. This thundered to 2,820 in Geekbench 6's single-core test, and 14,521 in the multicore section. Tremendous scores. As ever, gamers should steer clear, as reflected by 1,977 in 3DMark Time Spy and 20fps in *Dirt 5* at 1200p High settings.

The other hallmark of Snapdragon chips is superb battery life, but the MagicBook 14's return of 12hrs 34mins is distinctly average. You should still get a full working day's battery life, but evidently the high-resolution OLED display comes at a power cost.

So long as you have a T5 Torx screwdriver it's simple to remove the base cover, which reveals few repair options. If something goes wrong outside of the one-year warranty, you could face a costly bill.

Only the 60Wh battery is replaceable, though I was happy to see a vacant M.2 2280 slot to complement the supplied 1TB of storage.

The lack of repairability isn't surprising with such a slim design: it tapers down to 11.5mm at the front, and a weight of 1kg is a great achievement for a 14.6in laptop. Its magnesium alloy chassis feels superbly made, too, with no hint of flex on the base and only a hint on the lid despite its slenderness.

I have no complaints about connectivity, either, with two USB-C 4 ports on the left and USB-A, HDMI and a 3.5mm jack on the right. Wi-Fi 7 and Bluetooth 5.4 complete the forward-looking checklist, with NFC there to enable "Quick Share" if you own an Honor phone or tablet. If you don't, you may well find an offer in place at the point of purchase.

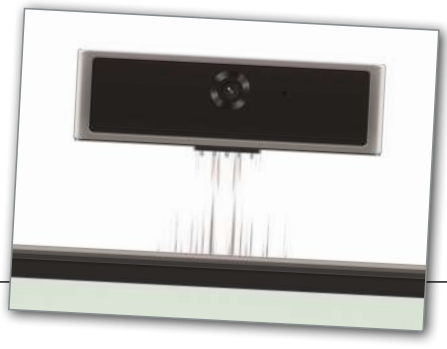
I can see why Honor wants to sweeten the deal, as €1,700 is a lot to pay even for a top-quality laptop such as this. At the time of writing, it was offering a voucher to take €200 off that price, along with an Honor Pad 9 tablet (this costs £220 at Argos). If I was in the market for an ultraportable laptop all these extras would certainly make me consider a trip across the Channel, but let's hope that Honor decides to sell the MagicBook Art 14 Snapdragon in the UK sooner rather than later. **TIM DANTON**

ABOVE **This 14.6in OLED screen has a pin-sharp resolution of 3,120 x 2,080**

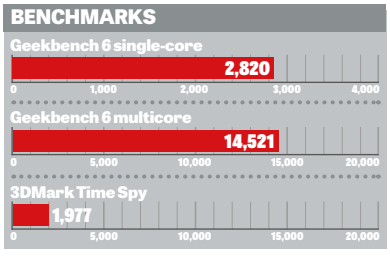
PC PRO RECOMMENDED

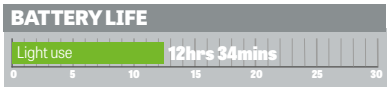
"Add a peak brightness of 486cd/m² and crisp whites, plus solid colour accuracy, and you have a great panel"

LEFT **The magnesium alloy chassis feels well made, with no hint of flex on the base**



BELOW **A magnetic webcam flicks out from the chassis when you click on it**





SPECIFICATIONS

12-core Qualcomm Snapdragon X1E-80-100 SoC ● Qualcomm Adreno graphics ● 32GB LPDDR5X RAM ● 14.6in 120Hz OLED touchscreen, 3,120 x 2,080 resolution ● 1TB M.2 PCI-E Gen4 SSD ● Wi-Fi 7 ● Bluetooth 5.4 ● 1080p webcam ● 2 x USB-C 3.2 Gen 2 ● USB-A 3.2 Gen 1 ● HDMI 2.1 ● 3.5mm combo jack ● 60Wh battery ● Windows 11 Home ● 317 x 224 x 11.5mm (WDH) ● 1kg ● 1yr RTB warranty

How we test

Laptops and PCs

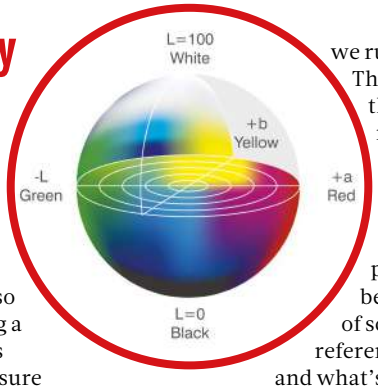
ABOVE We put PCs and laptops through our intensive set of benchmarks

We run a selection of benchmarks on all the PCs and laptops we test. Where possible, we use a cross-platform test so we can compare Windows and macOS machines, which is where both Geekbench and Cinebench come into play. Both push the CPU to its limit, exposing how well cooled a system is.

We run extra tests for Windows systems. We use PCMark 10 to benchmark systems in office tasks, content creation and basic tasks such as web browsing and video calls. We also run 3DMark Time Spy and *Shadow of the Tomb Raider* as a minimum. We test laptops and PCs that include discrete graphics with a range of games, such as *Metro Exodus Enhanced* and *Dirt 5*.

For laptops, we test battery life with Wi-Fi on and the screen brightness set to 150cd/m². We fully charge the laptops and drain them until they reach 5%. For Windows laptops, we will use a mix of PCMark 10's light-use and video-based tests, or a web surfing benchmark where a laptop automatically visits sites until the battery dies. We also use this test for MacBooks.

Screen quality



LEFT We use a Display i1 colorimeter to measure sRGB gamut coverage and Delta E

In each laptop, phone, tablet and monitor review, you'll see our conclusions about the screen quality. Some of this will be subjective, but we also test each screen using a X-Rite Display i1 Plus colorimeter. We measure maximum brightness, colour accuracy and (for monitors) consistency – there may be a difference in, say, brightness from the middle and the edges of the panel.

We also measure Delta E, which is a guide to how accurately panels display colours. Anything under 1 is excellent and likely to be difficult for the human eye to distinguish; between one and two is still strong; above this suggests a panel that you shouldn't trust for colour-accurate photo editing.

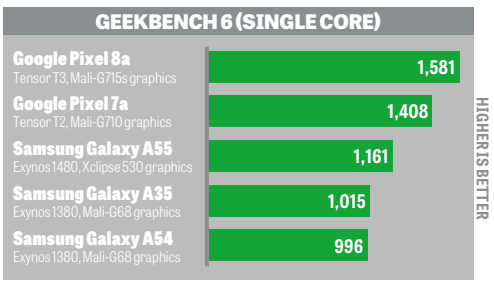
Phones and tablets

We run a selection of publicly available benchmarks on all the phones and tablets we review. First, we run Geekbench 6. This is a good test of the processor and memory in particular, and include both a test for single-core and multicore performance. See below for a selection of scores to provide a reference of what's good... and what's not so good.

We also run 3DMark Wild Life test to give a measure of gaming performance.

We test tablet battery life by playing a full-screen video until the battery runs out with the device. To simplify the test, we use Airplane mode. We set the brightness to as close to 150cd/m² as we can get in the device's settings. We also put phones through a set of real-world and labs-based tests.

BELOW We play a video with the screen set to 150cd/m² to test battery life



What our awards mean

Recommended
This, quite simply, is a product we recommend you buy – if it meets your needs.

A-List
The best buy in its category right now. The product will also feature on our A-List, starting on p14. It's updated each month.

Labs Winner
Each month we run a group test, or Labs. This product has managed to beat all others to top position.

Tinyurl.com links

Throughout the magazine you'll see tinyurl.com shortcuts. Enter these into the address bar of your browser and it will take you to a particular page, which will either be too long or awkward for us to publish or will take you to the precise shop from which to buy. If it's Amazon, note that we may have an affiliate deal in place so we will receive a commission from each sale. This will never affect our verdict of a product, and if another reputable vendor is selling the product cheaper then we will use that instead.

Prices will vary

Prices we publish are correct on the day we publish, but we often see prices change, especially on sites such as Amazon. However, we do work with British PC retailers to ensure the prices we quote for their systems are correct. If the price isn't being honoured, contact us via letters@pcpro.co.uk.

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Windows 11

SCAN 3S

Lenovo Yoga Slim 7i Aura Edition Gen 9 (15in, Intel)

Not the most exciting laptop, but this affordable Copilot+ PC has great stamina and a neat trick or two

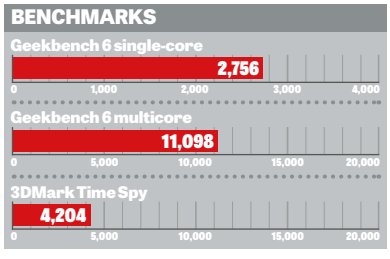
PC PRO RECOMMENDED

SCORE ★★★★☆

PRICE As reviewed, £1,167 (£1,400 inc VAT) from lenovo.com

After the excitement of seeing a Lenovo laptop with a rolling display (*see p29*) at CES, the Yoga Slim 7i seems rather ordinary. The display is boringly fixed in place, it uses Intel's well-established Core Ultra 7 258V processor, and the light grey finish is frankly dull. But despite my initial yawns on picking up the Slim 7i on my return from Las Vegas, there's a solid laptop here that deserves your consideration.

The first thing to mention is what makes it an Aura Edition laptop. This is the outcome of a partnership between Intel and Lenovo that aims to address the pain points revealed by a survey of tens of thousands of users. Pain points such as poor battery life, poor integration with phones and confusing customer support. If you're buying an Aura Edition laptop, you should therefore expect such problems to be a thing of the past.



The battery life problem

If we take the first pain point of battery life, then the Yoga Slim 7i delivers. It lasted for 20hrs 11mins in our light-use test, and even though that's with the screen set to 150cd/m² I'm confident that battery life won't be an issue with this laptop.

Lenovo provides a slim charger that it promises will provide "three hours of runtime on a 15-minute charge". In my own tests, it climbed to 19% in 15 minutes and to 36% after half an hour, which are solid results for a 70Wh battery.

The main reason for this laptop's longevity is its use of Intel's Core Ultra 200V "Lunar Lake" chips. You can either buy it with a Core Ultra 7 256V or a Core Ultra 7 258V, with the only difference between the two being that the 256V includes 16GB of RAM and the 258V doubles that to 32GB.

I tested the 258V version, and its results are typical for the processor. It's strong in single-core tasks, with a return of 2,756 in Geekbench 6, but if you're hoping for fantastic multicore speeds then you should look elsewhere. For example, it scored 11,098 in Geekbench and 582 in Cinebench R24, far behind the 12-core Honor MagicBook Art 14 Snapdragon (*see p52*) with 14,521 and 847 respectively.

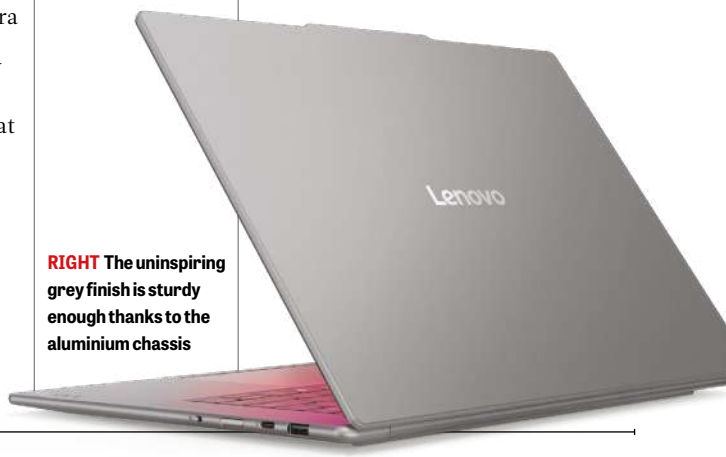
ABOVE The Yoga Slim 7i is a decent laptop, but the "Aura Edition" tag is fairly meaningless

Where the Core Ultra 7 258V wins is for gaming, with a 4,204 return in 3DMark Time Spy and a playable 41pfs in *Shadow of the Tomb Raider* – although I had to drop the settings from High (29fps) to Low. In *Dirt 5*, it returned 49fps at 1200p and High settings, dropping to 33fps at Low. Intel's chip includes a powerful NPU, too, and this is officially a Copilot+ PC.

"Lenovo and Intel hoped to make it easy to share files and photos with phones and tablets, but work still needs to be done"

Living in unison

Lenovo and Intel also hope to make it easy to share files and photos with phones and tablets, but work still needs to be done. At the launch demo,



RIGHT The uninspiring grey finish is sturdy enough thanks to the aluminium chassis

Lenovo showed off an Aura Edition app that, when loaded on phones, meant you could lightly tap on the side of the laptop and send photos instantly from one to the other.

That app hasn't arrived, so for now you're directed to install the Intel Unison app, use this to scan a QR code that pairs your phone to the laptop, and then drag and drop files between the devices. Which is fine, and works, but it isn't going to have Apple quaking in its boots. If anything, the experience demonstrates how Apple's tight control over its ecosystem gives it such an advantage over its rivals.

In Lenovo and Intel's defence, they aren't trying to create a siloed ecosystem. They want you to use an iPhone, and the Aura Edition app will supposedly work on iOS. But it's now six months after the launch and there isn't even an Aura app on the laptop.

Smart care

Not that I really want yet another piece of software. Lenovo already provides its Vantage app with its consumer laptops, and it's the place to go if you want to check battery health, updates, "bonus" software included with your purchase and security info.

It also provides warranty details, but not everyone knows about Vantage, which is why the QR code on a sticker mounted on the wristrest makes a lot of sense. This takes you to a unique page for your product, complete with your warranty details, specs for your machine and even your serial number. Fantastic for remote problem solving with tech support.

There's also a chatbot built into Vantage, called Lena, who you can ask questions. If Lena can't solve them, she'll provide a number for you to call or start a service request. As I know, because I asked her where the Aura Edition app was, and she hadn't a scooby. You can also head into the Vantage app and select "Chat with an Agent", so long as you try between 9am and 6pm, Monday to Friday.

Back to basics

So those are the main promises of an Aura Edition laptop. Some delivered, some absent. The good news, however, is that Aura aside this is a great laptop. It weighs 1.5kg, which is lighter than most 15.3in laptops despite its solid aluminium alloy chassis. I wouldn't call the Yoga Slim 7i beautiful – it's a regular grey-ish laptop – but it's slim at 13.9mm.

ABOVE Concave keycaps make the keyboard a pleasure to type on

The keyboard is a pleasure to type on, with 1.5mm of travel and a firm feel to each press, and Lenovo provides concave keycaps to help guide fingers. There's a double-height Enter key (on the UK version, not the US version pictured above) and large left and right cursor buttons, with only the up/down buttons being half height. Navigation is further helped by a smooth and responsive 80 x 135mm glass-coated touchpad.

Touching times

You can also navigate via the 120Hz IPS touchscreen, and it's another high-quality inclusion. Whites look best when you push it towards its maximum 524cd/m² brightness, and Vantage is once more your friend if you want to switch between the sRGB and DCI-P3 gamut. I kept it in the latter, where it covered 95% of that space with an average Delta E of 0.5. So, great colour coverage and accuracy.

A 1080p webcam and four-mic array sit in an island above the display – which also makes the lid easier to lift one-handed – but I was disappointed by its results. I'm so used to ThinkPads producing crisp, detailed images that the amount of blur and noise here took me by surprise. There's nothing wrong with the microphones, but if you want to make a professional impression during video calls then maximise your ambient lighting.

Fortunately, the speakers came to the rescue, reminding me that Lenovo targets this laptop at home users rather than professionals. If one of your primary uses of a laptop is to watch streaming video services, or you like to listen to music while tapping away, then I can recommend the Yoga Slim 7i Aura Edition.

LEFT A weight of 1.5kg and decent battery life help with portability

BELOW The Slim 7i is well served for connectivity

Well connected

It also a win for connectivity. On the right, there's a handy button to switch the webcam on or off, a USB-C port that supports both Thunderbolt 4 and USB 4, and a USB-A 3.2 Gen 1 port. Jump to the left and there's a second identically specified USB-C port, a 3.5mm combo jack and an HDMI 2.1 connector. Tri-band Wi-Fi 7 and Bluetooth 5.4 complete the set.

Flip the Yoga over and you'll spot a Carbon Neutral sticker, again with a QR code. This time it doesn't take you to a personalised page but a generic one describing Lenovo's efforts, which will explain how it's based upon credits that Lenovo purchases over the expected four-year lifespan of the laptop. Lenovo also uses post-consumer recycled plastics and recycled aluminium where it can.

Ultimately, though, the best way to make a product more sustainable is to extend its lifespan, and here Lenovo gets into my good books by providing a detailed hardware maintenance manual. However, few items are considered customer replaceable; it's more for technicians. There is ready access to the M.2 SSD at least, and you could replace the battery with some care, but that's it as the memory is integrated into the CPU package.

All of which means I would be tempted to order direct from Lenovo and add on a couple of extra years to the single year of cover that comes as standard. And this laptop might have been walking away with a Recommended award had the webcam been better and I had more confidence in the added value of the "Aura Edition" label. For the moment, it's simply too confusing. **TIM DANTON**

SPECIFICATIONS

8-core (4 P-cores, 4 E-cores) Intel Core Ultra 7 258V processor • Intel Arc 140V graphics • 32GB LPDDR5X-8533 RAM • 15.3in 120Hz OLED touchscreen, 2,880 x 1,800 resolution • 1TB M.2 PCI-E Gen4 SSD • Wi-Fi 7 • Bluetooth 5.4 • 1080p IR webcam • 2 x Thunderbolt 4/USB-C 4 • USB-A 3.2 Gen 1 • HDMI 2.1 • 3.5mm combo jack • 70Wh battery • Windows 11 Home • 344 x 235 x 13.9mm (WDH) • 1.5kg • 1yr Premium Care RTB warranty

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tinyurl.com/win11pro-upgrade

Want to upgrade from Windows 11 Home to Windows 11 Pro? Or perhaps you're looking to move up from Windows 10 Home?

Whatever your motives, a Windows 11 Pro upgrade licence is a great choice. The first reason is simple: price. Microsoft charges £119.99 for a retail licence of Windows 11 Home, a staggering £219.99 for Windows 11 Pro, and £119.99 for its own upgrade licence from 11 Home to Pro. By choosing this licence – and avoiding the many dubious sources of licences you may find online – you cut that price substantially.

Unlike Windows 11 Home, Windows 11 Pro enables you to connect to a business domain. It also provides BitLocker to encrypt whole drives. Best of all, you can create and host virtual machines using Hyper-V, which is ideal for testing new software or, if you're a developer, seeing how your software performs on a fresh OS.

Note that the upgrade only works from an activated copy of Windows 11 Home, so if you're currently using a Windows 10 Home system then you'll need to upgrade from that to Windows 11 Home before this upgrade can work.

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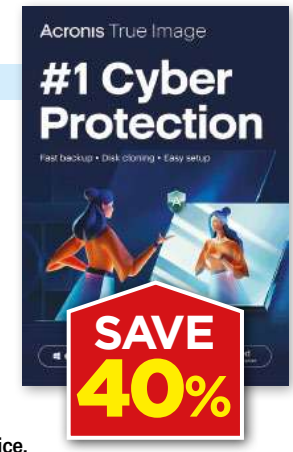
ACRONIS TRUE IMAGE 2025 ADVANCED for £29.99



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1 PC OR MAC | **1YR LICENCE**

tinyurl.com/trueimage2025

Acronis provides a one-stop security shop here, combining a full backup suite with comprehensive anti-malware protection.

It offers the full gamut of backup options, from individual files to complete drive imaging (with smart incremental and differential options to encourage daily backups without filling your storage), active disk cloning for migrating to faster or bigger hard drives, and support for cloud-hosted backups to give you access to your files from anywhere on any device.

There's also an Archive option for offloading larger files to the cloud, a Sync tool that works with two PCs with Acronis installed, and a host of additional disk-related tools, including system clean-up and drive-scrubbing tools, Acronis Secure Zone (an encrypted partition for storing sensitive files) and Acronis Universal Restore (a tool for migrating all your apps, documents and settings to a new PC).

Acronis True Image is simple to use, with a user-friendly front end that's packed with lots of wizards and step-by-step guides. And there's plenty of advanced tuning available to those who want full control over their system.

The Advanced package improves on Essentials by offering you 50GB of cloud storage. You can still back up to local disks, network attached storage or remote destinations via FTP. You can also back up Microsoft 365 data and set up automatic replication.

Raspberry Pi 5 16GB

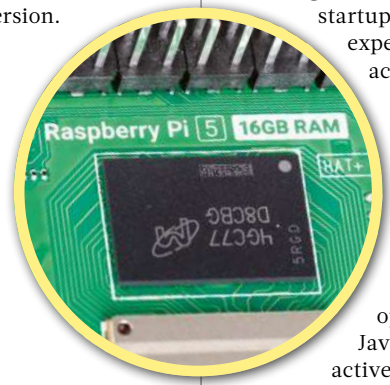
The Pi 5's power now comes with RAM to back it up, but the price means only die-hard fans should buy it

SCORE ★★★★☆

PRICE £96 (£115 inc VAT)
from thepihut.com

We've previously sung the praises of the Raspberry Pi 5 in our Pi buyer's guide (*see issue 363, p41*), and discussed the versatile range of 2GB, 4GB and 8GB models. Now there's a fourth option with a whopping 16GB – more than any previous Pi model. It's also the most expensive Pi ever, costing around £40 more than the 8GB version.

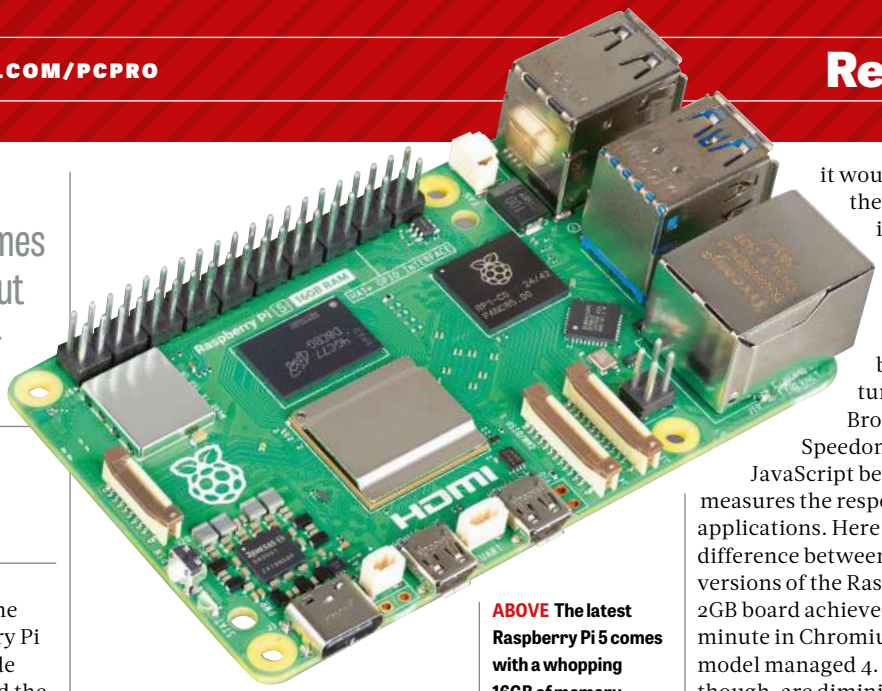
The 16GB Pi has the same capabilities and connectors as the 8GB model. The only differences are the RAM and the fact that this board uses the updated Broadcom BCM2712D0 CPU, as found on the 2GB version. This removes a few on-chip functions that the Pi doesn't need, making it slightly more cost-effective to manufacture, but to all intents and purposes it's the same platform as the 8GB Pi 5: the GPIO pinout, port locations and chip locations are identical, and any existing HATs, cases, cooling systems and other add-ons for the Pi 5 will work perfectly well.



To see what practical difference the extra RAM makes, I put the 16GB Pi 5 through a series of benchmarks. I started by measuring boot time, using the latest Raspberry Pi OS release on a 32GB Pi-branded microSD card. This showed no difference between the 8GB and 16GB models, both taking around 10.5 seconds – which isn't surprising, since the OS is designed to work on boards starting at 2GB of RAM.

That's not to say the OS doesn't take advantage of the extra memory. After the 8GB board had fully booted to the desktop, I noted that the OS was occupying 550MB of memory, while the 16GB model was using 657MB. That suggests more components are being pre-loaded, or given bigger buffers, for a snappier desktop experience.

I also ran a series of browser tests, since this is where desktop users are likely to spend much of their time.



ABOVE The latest Raspberry Pi 5 comes with a whopping 16GB of memory

Since the Raspberry Pi OS comes with a choice of two browsers, I tested startup times for both and was a little surprised to find that these were slower for the 16GB model than for the 8GB one. Chromium took six seconds to open, versus 3.6 seconds on the 8GB board, while Firefox took a languid 11.9 seconds, up from 9.7. Again, I assume this means more content is being loaded into memory at startup, for a better experience once you start actively browsing.

I then tried opening multiple browser tabs and checking memory consumption, just to see how far 16GB will stretch. With five tabs open – containing JavaScript, images and active content such as advertisements – I saw no difference between the 8GB and 16GB systems, with Chromium consuming around 1.5GB of RAM and Firefox demanding a slightly higher 1.7GB.

Working my way up to 50 tabs saw Chromium's memory footprint grow to around 4.1GB, while Firefox ate up 3.5GB. In other words, even this extreme scenario is within the capabilities of the 8GB model, though it would be a stretch for the cheaper variants – indeed, when I tried the same test on a 2GB Pi, the machine crashed.

As a final browser test, I turned to Browserbench Speedometer 3.0, a JavaScript benchmark that measures the responsiveness of web applications. Here I saw a significant difference between the two cheapest versions of the Raspberry Pi 5 – the 2GB board achieved 3.2 runs per minute in Chromium, while the 4GB model managed 4. Beyond that, though, are diminishing returns, with both the 8GB and 16GB models only raising the bar to 4.1 runs per minute.

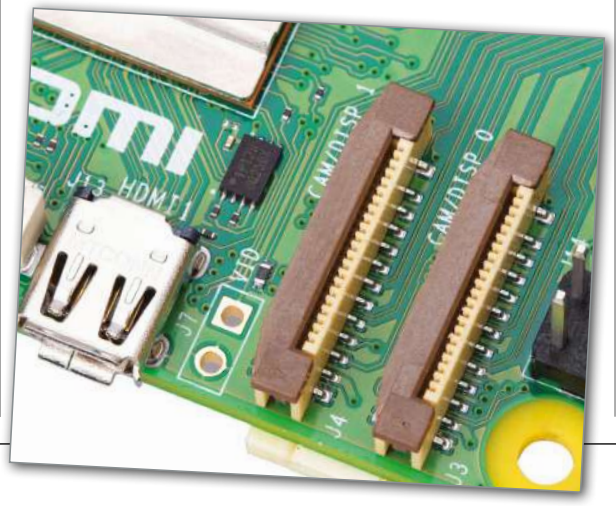
I also tried compressing a 1.4GB ISO image file using the gzip command-line utility. Surprisingly the extra RAM appeared to be a handicap here: the 4GB Pi completed the task in 66 seconds, while the 8GB model took 77 seconds and the 16GB one kept me waiting for 93 seconds. This appears to be a quirk of gzip, though, and shouldn't reflect general desktop performance.

"The 16GB Pi isn't an upgrade many people have been crying out for. Most projects and apps will run happily in 8GB or even 4GB"

Frankly, the 16GB Pi isn't the upgrade many people have been crying out for. Most projects and apps will run happily in 8GB or even 4GB, and will see little discernible benefit from the extra RAM. The price feels like a stretch, too: we're accustomed to thinking of Raspberry Pi systems as dirt cheap, but for around £50 more than this you can get a mini PC with an Intel N100 processor and a decent-sized SSD. If you're looking for a general-purpose desktop computer that might be a better choice, not least since it can run Windows as well as your choice of Linux distribution.

But if you enjoy using the Raspberry Pi 5 for everyday productivity and multitasking – or if you've invested in the Raspberry Pi AI HAT+ and want to crunch large data sets – this new model could be just the ticket. It's overkill for the "usual" Raspberry Pi projects, but it's the most capable Pi money can buy, and we can't complain too much about that. **LES POUNDER**

LEFT The board uses the updated Broadcom BCM2712D0 SoC



BELOW The GPIO pinout, port locations and chip locations are identical to the 8GB Pi 5

SPECIFICATIONS

2.4GHz Broadcom BCM2712 SoC with 4 x Cortex-A76 CPUs • 16GB RAM • dual-band Wi-Fi 5 • Bluetooth 5.0 • microSD card slot • 2 x USB-A 3.2 Gen 1 • 2 x USB-A 2 • 1GbE port • 2 x 4-lane MIPI camera/display transceivers • PCI-E 2.0 interface • USB-C input for power • Raspberry Pi standard 40-pin GPIO header • power button • 85 x 56mm (WD) • limited warranty

Intel Arc B570 and B580 Graphics

Battlemage architecture has turned Intel Arc cards into solid mid-range alternatives to AMD and Nvidia

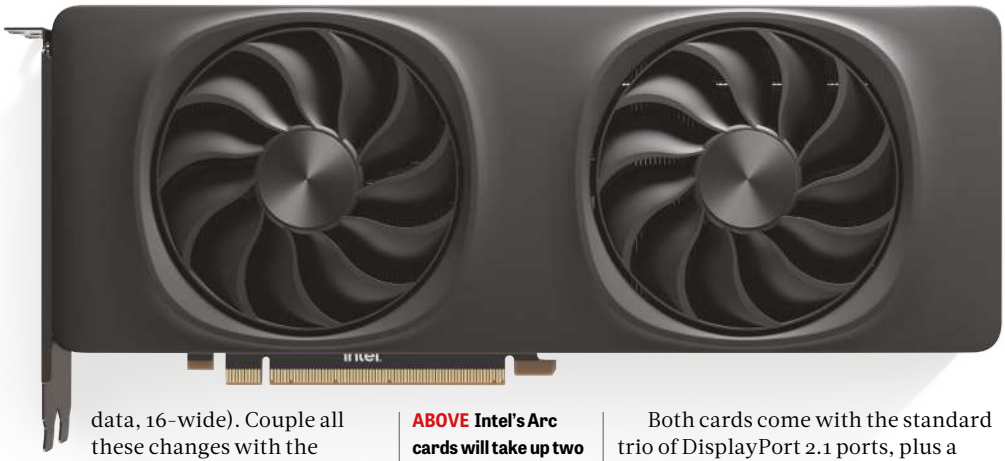
B570
SCORE ★★★☆☆
PRICE £175 (£205 inc VAT)
from amazon.co.uk

B580
SCORE ★★★★☆
PRICE £200 (£240 inc VAT)
from amazon.co.uk

Nvidia may have set the world of high-end graphics cards alight at CES 2025, but weeks earlier Intel had jumped its rivals by releasing two cards based on its Battlemage architecture. With much-improved drivers compared to the first round of Intel Arc GPUs, it's now a genuine alternative to Nvidia and AMD if you have between £200 and £250 to spend.

On paper, the B580 looks far less powerful than the existing A750, never mind the full-fat A770 16GB card. The B580 has "only" 20 Xe-cores, compared to 28 on the A750 and 32 on the A770; even the lowly A580 has 24 Xe-cores.

The real story is that Battlemage has major architectural design changes, which means that ray tracing sees a 1.5x to 2.1x improvement per Xe-core, for example. Mesh and vertex throughputs see improvements of 2x or more, as does sampler feedback. Another big change is the move to native SIMD16 instructions, compared to Alchemist's SIMD32 units (SIMD16 stands for single instruction multiple data, 16-wide). Couple all these changes with the higher boost frequencies and the results you see in the graphs opposite are far less surprising.



ABOVE Intel's Arc cards will take up two slots but have plenty of room for cooling

Limited appeal

As with Alchemist, Intel is selling a reference design Arc B580 Limited Edition card. That "Limited" is for branding, not necessarily because the cards will only be offered in limited quantities. The only notable change compared to its A750 predecessor is the removal of the extra 6-pin power connector. Now, the B580 has a single 8-pin connector that, when combined with the 75W from the PCI-E slot, can deliver 225W of total power to the board. That leaves a decent amount of headroom for overclocking as well.

It's not particularly small (272 x 111 x 39mm, so will consume two slots), but that leaves plenty of room for cooling, and the whole length of the card's interior is filled with radiator fins. The result is a quiet-running card.

There's no such reference card for the B570, with Intel sending us an ASRock Arc B570 Challenger OC. Early indications are that all the partner B570 cards perform similarly, so the results opposite should be an accurate reflection of the GPU's capabilities. Like the B580, it's a dual-slot card, but slightly shorter at 248mm.

Both cards come with the standard trio of DisplayPort 2.1 ports, plus a single HDMI 2.1 port.

Creative tasks

Modern GPUs aren't just about gaming. They're used for video encoding, professional apps, and increasingly for AI. We tested across a range of AI benchmarks, and it's notable that the Arc B580 beat its rivals – including the RTX 4060 – in all of them. It did particularly well in the Stable Diffusion test, as shown opposite, where the B570 was also strong.

"We tested across a range of AI benchmarks, and it's notable that the Arc B580 beat its rivals in all of them"

In Blender, Nvidia's combination of firepower and highly optimised drivers pushed it to the top. I'm not too concerned by the B580 and B570 being beaten by the older Intel cards, as I suspect that's a driver fix away.

We've combined the scores across SPECworkstation 4's viewport graphics suite, which includes seven applications. AMD provides the most "professional" performance in its consumer drivers, roughly doubling the performance of the Arc B580. The only test where the B580 beat the RTX 4060 is the medical benchmark. Otherwise, the three Arc GPUs occupy the bottom three slots on each chart. I suspect driver tuning could again help Intel a lot in these tests.

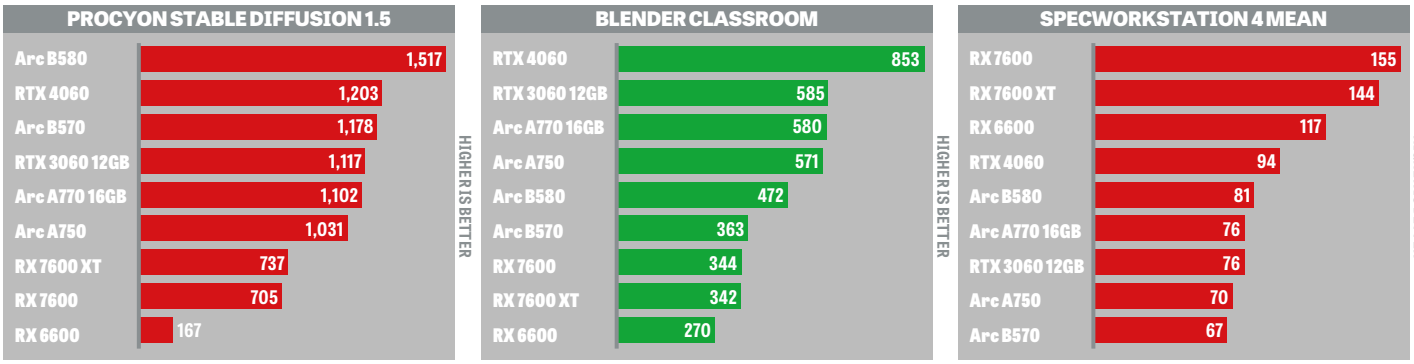
Rasterisation performance

Pure rasterisation – the process of converting vector graphics into raster graphics, so the dots that appear on screen – remains the most compelling gaming test for graphics cards, and our 16-strong testing suite allows us to see how each card performs across a range of titles and genres. And there's excellent news here for the Arc B580 in particular: not only does it come out ahead of the competition in most cases, but it also easily eclipses the previous generation Arc A770.

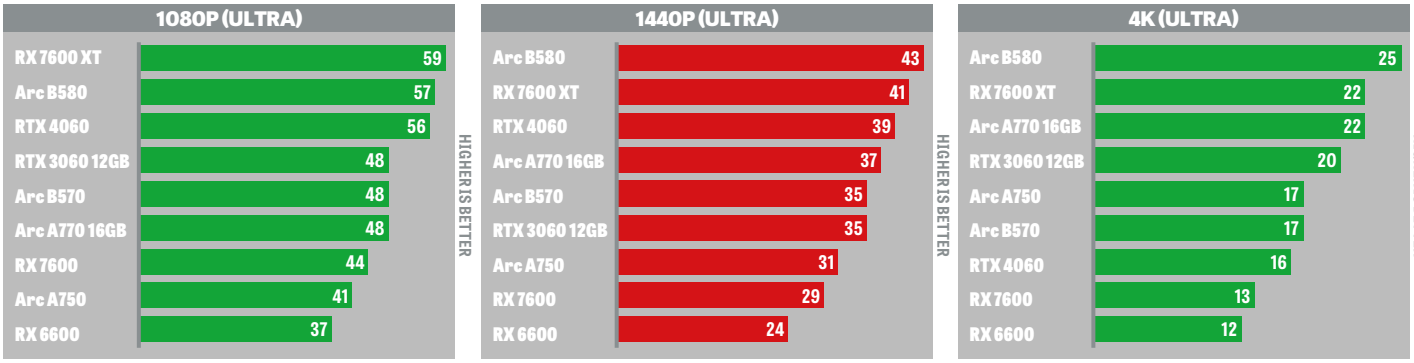
Against the Nvidia RTX 4060, the incumbent budget-mainstream GPU, the Arc B580 ends up leading by a comfortable 10% at 1440p Ultra. The gap narrows at 1080p, where it's only 3% faster at Ultra settings and 1.5%

	Arc B580	Arc B570	Arc A770 16GB	Arc A750	Arc A580
Architecture	Battlemage	Battlemage	Alchemist	Alchemist	Alchemist
Xe-cores	20	18	32	28	24
Shaders	2,560	2,304	4,096	3,584	3,072
XMX cores	144	144	512	448	384
RT cores	20	18	32	28	24
Boost clock	2.85GHz	2.75GHz	2.4GHz	2.4GHz	1.7GHz
VRAM	12GB	10GB	16GB	8GB	8GB
VRAM speed	19Gbits/sec	19Gbits/sec	17.5Gbits/sec	16Gbits/sec	16Gbits/sec
VRAM bus width	192-bit	160-bit	256-bit	256-bit	256-bit
Max power draw	190W	150W	225W	225W	185W

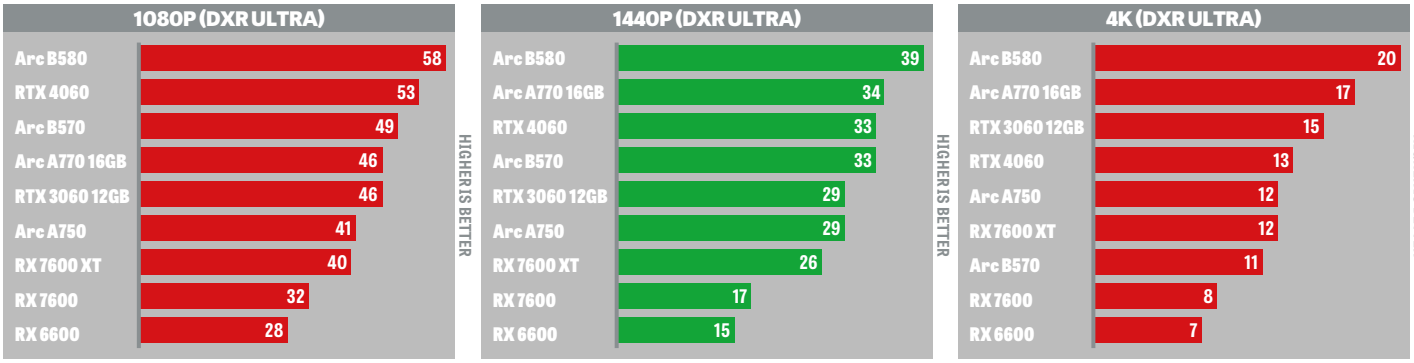
PROFESSIONAL & CREATIVE BENCHMARKS



16-GAME RASTERISATION MEAN



6-GAME RAY TRACING MEAN



"Ultra" refers to highest setting in each game. The test rig used an AMD Ryzen 7 9800X3D CPU on Windows 11 24H2.

faster at Medium, so pretty much tied. And although it's mostly meaningless, it's 48% faster in our 4K Ultra results. The 4060 runs out of VRAM in several games, which tanks performance.

AMD's RX 7600 and RX 7600 XT trade blows with the RTX 4060, with the 7600 XT clearly pulling ahead at higher resolutions thanks to its 16GB of VRAM. The 7600 XT also takes the top spot at 1080p Medium, ties with the B580 at 1080p Ultra, and then falls behind at 1440p and 4K.

As for the Arc B570 – well, it's hard to argue that it's worth saving £30 or so when the performance drops so much compared to its sibling.

BELOW The Arc B580 is arguably the best-value graphics card you can buy

Ray tracing

Our mean for ray tracing looks very different from the rasterisation numbers. Where AMD's RX 7600 XT could be competitive in rasterisation games, it falls well behind on ray-tracing performance. Nvidia's RTX 4060 card hardly excels, hobbled by its 8GB of VRAM, but it easily pulls ahead of AMD's offerings.

Intel's Arc B580 matches the RTX 4060 at worst (at 1080p Medium), and starts pulling away at higher-quality settings and resolutions. Even the Arc A770 manages to surpass the 4060 at 1440p Ultra. And there's good news for the B570, too, until we look at the 4K graph – but you're probably not planning on running maxed-out 4K at native resolution on a £250 GPU, so that's only there for reference.

Final word

I have to give Intel credit: entering the dedicated GPU market was always going to be difficult. It tried to do so back in the late 1990s and then gave up. Some people assumed the same would happen this time, but the B580 and Battlemage suggest that Intel remains committed to being competitive in the GPU arena.

The next-generation Celestial architecture is apparently already under way, and if that continues, we should see Arc C-series GPUs in the next year or two – probably first as an integrated solution on a future processor, just like Battlemage.

The good news is that Intel's Battlemage is more compelling than its predecessor. It delivers better performance, improved efficiency and impressive AI skills.

Right now, you can argue that the Arc B580 represents the best-value graphics card on the market. Whether that's true in another month or two hinges on how aggressive AMD is with the pricing of its forthcoming budget GPU. **JARRED WALTON**

DJI Flip (RC-N3)

A great-value, lightweight drone that captures detailed 48MP stills and records gorgeous 4K/60fps footage

SCORE ★★★★½

PRICE RC-N3, £308 (£369 inc VAT) **from store.dji.com**

The DJI Flip is the drone giant's latest offering, and it might well be its most appealing one yet. For a very reasonable price it captures stunning stills with a high-quality 48MP camera, and can also film smooth and sumptuous 4K video that looks as good as anything you'll get from far more expensive models.

The headline price of £369 includes the drone and basic RC-N3 controller, which connects to your smartphone to show the live view from the drone's camera. In my view it's worth stepping up to the £549 bundle with the RC-2 controller, which has its own integrated 5.5in touchscreen for a neater, more engaging flying experience. The Fly More combo adds two spare batteries, a charging hub and a shoulder bag for £659; you'll also probably want to invest in a microSD card, as the Flip's internal storage is limited to only 2GB.

Flight response

The drone itself resembles a *Star Wars* droid, and I don't mind that at all. It's made of high-quality, light grey plastic, and doesn't look or feel cheap. On the right edge of the drone's body sits the power button, while the left edge houses the QuickShot button (which we'll discuss below). There's also a small screen above the camera that displays the active QuickShot mode.

Since the propellers are encased in guards, you can fly the Flip either outdoors or inside without worrying about damaging the rotors or the furniture; when not in use the rotors fold underneath and click neatly into place, ensuring they stay secure and reducing the travelling size to 136 x 62 x 165mm. It isn't heavy, either, at 249g. During my testing I carried the drone, RC-2 controller, spare batteries and charging hub around in the included shoulder bag for hours and didn't feel uncomfortable at all.

ABOVE The DJI Flip captures high-quality stills and video at a very reasonable price

Actually flying the thing is very enjoyable. The Flip features palm take-off and landing, so you can simply hold out your palm underneath the drone and it will land in your hand. The RC-2 controller's detachable joysticks feel good under your thumbs, and the display shows clear, low-latency footage. Thanks to its four antennas, the controller can communicate with the drone over a claimed operating range of up to 20km; since the Flip has a maximum flight distance of 14km, that's not something you need worry about. The only limitation to note is that the Flip features forward obstacle avoidance only, so you'll need to be careful when manoeuvring sideways or backwards; for comparison, the DJI Mini 4 Pro features omnidirectional obstacle avoidance, although the Mini 3 doesn't feature any at all.

Shoot to thrill

One of my favourite parts about the Flip hardware is its camera mount, which uses a three-axis mechanical gimbal to ensure footage remains smooth while the drone zooms about, even when buffeted by gusts of wind. This makes a real visible difference to your results: by contrast, the DJI Neo's single-axis design can produce choppy footage in windy weather. Like the DJI Mini 3 and the Mini 4 Pro, the Flip remains stable in conditions up to 10.7m/sec (roughly 25mph).

BELOW Here's what you get in the DJI Flip RC-N3 pack

PC PRO RECOMMENDED

A plethora of shooting modes is on offer, including MasterShots (where you can program a flight path to create long cinematic sweeps and pans), Hyperlapse, panoramas and vertical shooting. As mentioned above, the Flip also supports DJI's signature QuickShot mode, which gives you a quick and easy way to capture timed videos with specific drone movements, such as circle, rocket, spotlight and so on. You don't even need to use the controller to set your QuickShot mode: pressing the button on the Flip's left lets you cycle through the modes, and the drone will then take off and finish filming automatically, with AI subject tracking used to keep the subject in focus.

"The Flip features palm take-off and landing, so you can simply hold out your palm underneath the drone and it will land in your hand"

LEFT Your phone slips into the RC-N3 controller so you can view the live action

As for image quality, the DJI Flip has the same 1/1.3-inch CMOS sensor as the DJI Mini 4 Pro, capturing either 12MP or 48MP stills. You can choose to shoot in RAW mode for maximum creative freedom in post-production, but even the straight-out-of-camera JPEGs are very detailed and colourful. You can see a couple of examples of 48MP stills in the gallery opposite: in the first shot, I love how the Flip has captured the different shades of green and the way the sun shines on the foliage on the left-hand side. The frost on the ground looks great, too, and the Flip's f/1.7 aperture means it even does a decent job in low light – better than you'll get from other drones in this price range.

Switching to 12MP mode allows you to squeeze more images into your available storage, and lets you take advantage of a 3x crop zoom option. Naturally, though, 12MP images aren't as detailed as 48MP ones: in the middle photo, with me in shot, you can see that my features are barely discernible and the overall image is quite grainy.

Photo gallery

Along with this selection of photos, you can see sample video footage from the DJI Flip (shot by our sister title Tom's Guide) at tinyurl.com/366flip

48MP MODE Stick to 48MP and you'll capture stunning amounts of detail, or save space and switch to 12MP

ZOOM The Flip offers a 3x "crop zoom" in 12MP mode that gets you closer to the action

SPHERES In this mode, the drone captures 25 shots and stitches them together to create a 3D landscape

PANORAMA You can shoot classy panorama shots such as this, and even create 3D landscapes

Extra modes

Wide horizontal panoramas, meanwhile, look as good as those shot on the much more expensive DJI Air 3S, and the Flip can also capture photospheres, where the drone hovers in one spot and captures an all-round view across 25 frames. These are then automatically stitched together to create a 3D landscape, which you can zoom into on either the RC-2 controller or your smartphone, much like street view on Google Maps.

The DJI Flip shines equally when shooting video. It can capture footage at resolutions up to 4K at 60fps, with a 100fps option also available when filming in 1080p. The combination of these high frame rates with the three-axis gimbal ensures that everything looks beautifully smooth, although if you intend to share your footage on Instagram and the like, you'll be pleased to know you can save space by dropping down to 30fps.

Impressively, you also get full manual control over the camera settings, so you can adjust the shutter speed, exposure and ISO (up to 6,400), or let the drone automatically select the best settings. You can even shoot in D-Log M, allowing the drone to capture a wider dynamic range to give you more freedom when using professional tools to grade your footage.

Digital zoom options for shooting video go up to 3x when filming in 2.7K or 4K resolutions, or up to 4x for Full HD. As with stills, you lose detail when zooming in fully and footage starts to appear fuzzy, but it's still good to have the option if you want to capture something in the distance.

Take control

If you're using the RC-2 controller then all of the camera controls can be accessed directly from the touchscreen, but if you've opted to stick with the standard RC-N3 controller you'll need to install the free DJI Fly companion app on your smartphone. As well as controlling the camera, this is your one-stop shop for checking nearby fly spots and restrictions, updating the controller and drone firmware, sharing your footage with other DJI users and uploading footage to your phone.

As usual with drones, the only limitation to your creativity may be the amount of time the thing can stay in the air. I tested the DJI Flip in moderately windy conditions and found it remained aloft for around 31 minutes, all the while recording in 4K at 30fps, before it needed to return home and recharge. That's less than the cheaper DJI Mini 3, which can navigate the skies for 38 minutes. Once the Flip runs out of juice, you can charge it via the onboard USB-C port, but this takes just under 90 minutes to go from zero to 100%. For this reason I recommend investing in the spare batteries and charging hub. Thankfully the RC-2 controller lasts longer, operating for up to four hours on a 90-minute charge.

"The combination of high frame rates with the three-axis gimbal ensures that everything looks beautifully smooth"

BELOW The propellers fold neatly under the drone when not in use, making it easy to carry

Will it take off?

Whether you're looking to upgrade from an older DJI drone or considering your first purchase, the Flip is the perfect midpoint between feature-limited budget models and professional-grade flyers. It does have its shortcomings: as I've mentioned, the light frame makes it susceptible to strong winds, and front-only obstacle avoidance means you'll need to fly with care. Battery life is unexceptional, too.

Overall, though, the DJI Flip delivers a fantastic flying experience, with great build quality and a compact design that's perfect for travelling with. The 48MP camera captures detailed stills in both bright and dimly lit environments, and delivers stunning 4K video footage, along with striking panoramas and spheres. Factor in DJI's QuickShot mode and a brilliant, easy way to grab popular types of video clip, and there really isn't a better drone out there for amateur aerial photographers. **ITA ACHANTA**

SPECIFICATIONS

48MP camera (82° FoV, 4K video at 60fps) • 3,110mAh battery • 2GB storage • microSD card slot • RC-N3 remote controller • GPS, Galileo, BeiDou • 136 x 62 x 165mm (WDH, folded without propellers) • 249g • 1yr warranty

Acer PD3 Series

Two really is better than one when it comes to portable screens, but there's no denying the PD3 Series' bulk

SCORE ★★★★☆

PRICE £250 (£300 inc VAT)
from store.acer.com

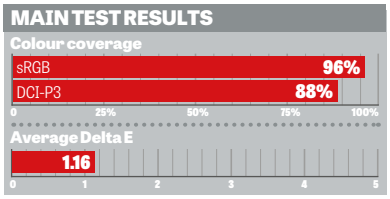
Forget bendable screens: sometimes simplicity is best, and that's exactly what Acer opts for with this dual portable monitor. It's slapped a pair of 15.6in IPS panels into a plain but effective plastic casing, added a sturdy stand, and in doing so provided a surprisingly versatile way to expand your laptop's display.

You can position the PD3 Series (model number PD193Q) in several ways. I tried it in portrait mode with a bend in the middle, as shown to the right, portrait without the bend, in landscape mode (where it's like a 22in panel but with a big bezel in the middle), and in tent mode so that someone else could view the content of the other display while I was working on the "main" screen.

What really lifts the PD3 Series above traditional portable monitors, though, is its size. I find traditional portable monitors frustrating, as they simply don't give me enough extra space to make the hassle of bringing them worthwhile. I constantly yearn for my main setup, with a spacious monitor on which to scatter windows. Having two 15.6in monitors to play with, especially as you can select "Fill" in Acer's OSD to treat them as one monitor, makes a colossal difference – to the point that I'm a little annoyed Acer didn't send me this to test before I went to CES (*see p26*) rather than after it.

One disadvantage of Acer's solution is that it opts for 1,920 x 1,080 panels rather than 2,560 x 1,440, which means that you lose out on detail. It's not a deal-breaker, especially if you switch to 150% scale in Windows' settings (rather than the recommended 200%), but I missed the sharpness that a 4K 27in desktop monitor brings.

MAIN TEST RESULTS



All measurements in default profile

The panels' quality is surprisingly good considering you're paying £150 per unit, with 96% coverage of the sRGB gamut and 88% of DCI-P3. Not only do colours look vivid, but whites are genuinely excellent. An average Delta E of 1.16 reflects good colour accuracy, too. Perhaps most importantly, both panels behave identically when it comes to colour reproduction, so there's no cognitive dissonance when you switch from one to the other.

Acer sticks to the simple theme when it comes to connectors and the onscreen display. It's powered by a 45W USB-C wall plug, which slots into one of the two USB-C connectors. You can then connect to your computer via the other USB-C port or an HDMI connector. These ports all sit on the left side of the monitor, with the controls for the OSD on the right. There are a few options, such as modes for gaming, reading and movies, but these fiddle at the edges – think sharpening, response times and contrast – rather than changing the colour profile of the panel.

PC PRO RECOMMENDED

ABOVE The PD3 Series can be set up in four main positions, including tent mode

But that's fine, as all most people will want to do is adjust brightness. Here the two panels differed, with the top one hitting 245cd/m² while the bottom reached 261cd/m², but I couldn't spot this with my naked eye.

Acer also builds in a pair of 2W speakers, and by portable monitor standards they're respectable. There's little bass, but if you want to play background music or use them for a video call they do the job. It's also easy to control the volume: press the rocker switch that you use for up/down navigation in the OSD.

The only area where this monitor moves into dubious territory is portability. It's heavy at 2.3kg (ignore the 1.5kg you might see on Acer's website, as that refers to a different model in the series), but it's roughly the size of an 18in gaming notebook so you'll struggle to fit it into a standard rucksack alongside your laptop. I'd only bring it on my travels if I was also taking a suitcase, at which point the fact that it folds inwards when not in use becomes an advantage, as you don't need to worry about protecting the screens.

"The panels' quality is surprisingly good. Not only do colours look vivid, but whites are genuinely excellent"

Still, that's only one scenario. The proverbial "travelling salesman" could sling this into the boot of their car, ready to whip out during presentations to clients – the point at which the tent mode becomes useful. You can also mount this on an arm if you occasionally need extra space, thanks to a 100 x 100mm VESA mount (again, ignore Acer's site that says 75 x 75mm). Or maybe you regularly visit shared workspaces where there isn't a dedicated screen you can use. Just remember that you'll always need a separate 45W power source, whether via a USB-C cable or the supplied plug.

LEFT The displays fold inwards, protecting them when you're travelling

BELOW While portable, the PD3 Series is still fairly bulky

Overall, I can only applaud Acer's execution. The stand provides all the flexibility you need, and although it's by no means perfect – I would have liked higher-resolution panels, the bezel that separates them is thick and the whole unit is chunkier than ideal – it's a buy that any frequent traveller should consider. **TIM DANTON**

SPECIFICATIONS

2 x 15.6in 1,920 x 1,080 IPS panels up to 60Hz • 6-bit (262,000) colours • 8ms response time • 2 x USB-C 3.2 Gen 1 • HDMI • 3.5mm audio out • VESA mount (100 x 100mm) • 2 x 2W speakers • 376 x 217 x 24.4mm (WDH) • 2.3kg • 1yr limited warranty • part code PD163Q

DRAYTEK

PC PRO TECHNOLOGY EXCELLENCE AWARDS 2024 WINNER

TRIED, TRUSTED & RECOMMENDED

When it comes to building a wireless network that *PC Pro* readers trust, DrayTek has over a decade's worth of trophies in its award cabinet

When choosing infrastructure for your network, you need top-quality hardware and reliable support. But with so many router manufacturers out there, how do you know which can be relied on?

The answer is to ask satisfied customers – and you'll find plenty recommending DrayTek. In our annual *PC Pro* Excellence Awards, the firm has been named best router manufacturer for the past three years running. That's an achievement that reflects not only excellent Wi-Fi performance but also reliability and customer service – plus, of course, value for money.

It's an achievement that really means something, because the awards are voted on by *PC Pro* readers. And when – as in the latest 2024 awards – a staggering 96% of customers said they'd stick with DrayTek for their next router, you can be confident that it's a smart purchase.

Why DrayTek?

What makes *PC Pro* readers keep recommending DrayTek? For many it's peace of mind: in the 2024 awards, 96% of customers said they were highly satisfied with their DrayTek router's reliability; the year before it was 97%, and 95% in 2022. "They just work, and work well," said reader Martin Packer.

Of course, performance is important, too, and here again DrayTek didn't disappoint, offering Wi-Fi access points rated for up to a massive 6Gbits/sec. In 2024, 93% of customers said they were happy with the network speeds from their DrayTek router, and 90% were highly satisfied with their Wi-Fi range.

Others appreciate the powerful range of features, with different models offering business-class features such as load balancing, 5G SIM support, hardware failover and integrated VPN server. An "amazing product", said reader Chris Davies: "the functionality is streets ahead of the ISP-provided box."

DrayTek also earns praise for the seamless integration between the router and other networking components. "Bought [router] with DrayTek switch and access points to build a proper home network," wrote Richard Lord. "Awesome piece of kit." And with centralised administration for the router, APs and switches, it all works together.

A question of support

Perhaps most importantly, DrayTek scores very highly when it comes to customer support, with an unbeaten 91% satisfaction rating in the latest awards. That's largely thanks to the company's knowledgeable, UK-based helpline – but there's also a wealth of online resources to help, including technical documentation, a lively user forum and even simulated web portals for numerous router models, so you can fully explore each one's management interface and check the features before you buy.

For all these reasons, DrayTek routers inspire long-term loyalty. *PC Pro* reader Ian McCulloch wrote: "I have used DrayTek some 20 years; best internet connection devices I have ever used. Very secure." Simon Reynolds echoed: "I've been using DrayTek comms equipment for many years, very happy with them."

Industry recognition

Naturally, DrayTek isn't short of industry accolades. The company was recently named Specialist Vendor of the Year at the 2024 CRN Awards – for the second year running – for achievements such as being picked by CSL and Vodafone as the exclusive networking supplier for the National Lottery Connectivity Project.

And right here in *PC Pro* the company's no stranger to awards. The DrayTek Vigor 2927Lax-5G was Highly Commended in our 2024 Product of the Year ratings, and remains on our A-List (*see p19*). In our review we praised not only its value for money but also its "incredible range of WAN failover features, being super simple to manage and even including integral Wi-Fi 6 services".

Prior to that, we recommended the DrayTek Vigor 2866ax router – "a great choice for small businesses that want reliable internet and security services in one unit".

Top new routers from DrayTek

DrayTek provides professional-grade routers, access points, switches and more, for environments of all sizes. The latest products include:

Vigor 2136ax AX3000

Wireless router

A high-performance router with built-in VPN capabilities and 2.5GbE WAN and LAN ports – ideal for fast fibre connections. It also includes content filtering and Quality of Service controls, so you can fully manage your network traffic, plus a versatile firewall for keeping your network secure.

VigorAP 805

Mesh wireless access point

This access point offers wireless physical rates of 2.4Gbits/sec on 5GHz and 600Mbits/sec on 2.4GHz bands with an ultra-fast 2.5GbE uplink – plus an additional gigabit Ethernet socket for wired connections.

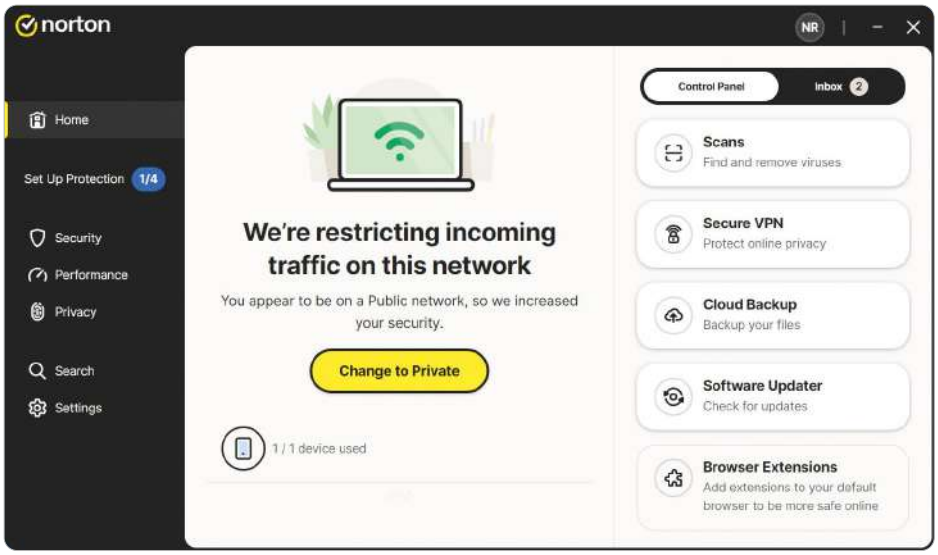
Whether you're kitting out a home office or managing a business network, DrayTek provides fast, reliable infrastructure with great support – and you don't have to take our word for it.

Your bonus software

Total value this month £230

We scour the globe to negotiate the best software deals for our readers, from extended licences to full programs you don't need to pay a penny for. Here's this month's lineup

Norton 360 Standard 2025



One-device, 15-month licence worth £65
uk.norton.com
REQUIRES Windows 8 or later; 300MB hard drive space; online registration

Norton's comprehensive security suite includes everything you need to protect your device and data – from a VPN to cloud backup, password management and more.

The Norton Security module is a headline feature, bringing you strong protection against all types of malware. It monitors files and programs not just for known threats but also suspicious behaviour, so it can block malware before it gains a foothold on your system. There's a firewall, too, to automatically block attacks from both outside and inside your PC, while web safety components check the links you click to make sure they're safe to visit. Downloaded files are screened for both security and reliability, and you'll benefit from comprehensive cleanup, disk optimisation and startup manager tools to keep your PC maintained.

Norton 360 also now includes Norton Secure VPN as standard. Using a trusted VPN is a great way to protect yourself from snoopers when browsing the web, particularly if you're using an unsecured Wi-Fi network on a mobile device. You can also use a VPN to make it appear that you're browsing from another country, for purposes such as watching UK TV while abroad.

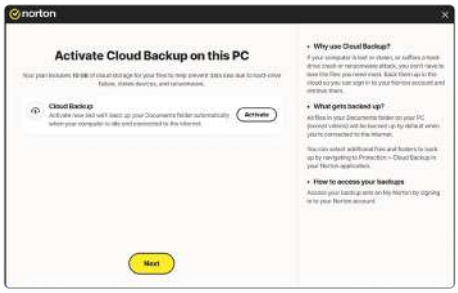
Dark web monitoring is another inclusion, courtesy of Norton LifeLock. This keeps an eye on personal information such as email addresses and passwords, and alerts you if they're compromised, so you can quickly update your credentials.

You can also protect your most important files using Cloud Backup. This module can help you recover from a hardware failure or ransomware attack by restoring your essential data from the cloud. The Standard licence includes 10GB of online storage, enough for your most irreplaceable files.

Another key feature is Norton's multi-device password manager. This can securely store your login data and passwords for retrieval on any device, with extensions for Edge, Chrome, Firefox, and Opera that make it easy to access your passwords directly within your browser.

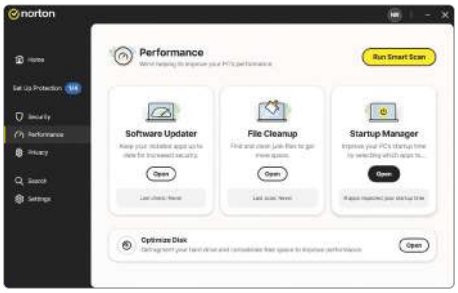
Finally, Norton's parental controls let you apply age-based restrictions to kids' devices, and monitor and manage their internet access, browsing times and content restrictions.

Norton 360 Standard works on both desktop and mobile devices, and you can activate this version on one device running Windows, macOS, iOS or Android for 15 months.



ABOVE Norton 360 Standard includes 10GB of cloud storage, to secure essential files in case of a ransomware infection or hardware failure

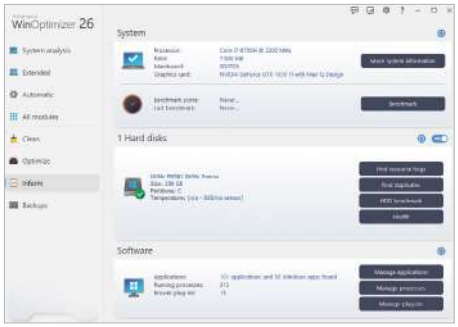
ABOVE Norton's Secure VPN creates a secure tunnel between your PC and remote servers to encrypt and disguise your internet traffic



ABOVE Performance tools can reduce clutter and make sure that you're running the most recent versions of each app installed on your machine

Ashampoo WinOptimizer 26

- Comprehensive PC maintenance, cleanup and optimisation suite
- Remove left-over Windows and application files, plus traces from Edge, Firefox, Chrome, Opera and Safari
- Delete unnecessary duplicate files and broken shortcuts; identify and purge space-hogging folders



Full product worth £44 ashampoo.com
REQUIRES Windows 7 or later; 75MB drive space; online registration

Abelssoft CryptBox 2024

- Keep your personal and sensitive files safe from prying eyes with this easy-to-use encryption suite
- Encrypt individual files or turn folders into encrypted vaults that you can add to over time
- Secure your data using 256-bit AES encryption so it can only be accessed by entering your chosen passcode

Full product worth £30 abelssoft.com
REQUIRES Windows 10 or later; 40MB drive space; online registration

Audials Radio 2025 SE

Full product worth £19 audials.com
REQUIRES Windows 8 or later; 3GB drive space; online registration

- Find and listen to online radio stations worldwide
- Bookmark favourites and scroll back through stations you've already listened to
- Record online streams and pool music from other sources, including iTunes

Ascomp Synchredible 8

Full product worth £33 ascomp.de
REQUIRES Windows 7 or later; 75MB drive space; online registration

- A straightforward tool to keep your drives and folders synced with the minimum of hassle
- Specify the sync direction, how to handle missing files and more
- Refine your task with include and exclude filters

O&O Defrag 27 Professional

Full product worth £39 oo-software.com
REQUIRES Windows 10 or later; 120MB drive space; online registration

- Powerful, highly configurable hard drive defragmentation software for top performance
- Organise files as you choose, including options for filename, last modified date and more
- Can work in the background while your PC is idle

How to claim your bonus software

1 Visit **pcprodownload.co.uk.** First, enter the issue number (366 this month). Next, enter your email address and the coupon code printed on the cover's spine (or directly on the front cover of digital issues of the magazine). We'll then send an email to confirm that your code has been registered. Follow the instructions in the email to access the download area.

2 Once you're in the download area, you can access this month's bonus software by navigating to the relevant product page and clicking the red Install button. For trial software, freeware and other downloads, click the Install button below the product description, or follow the onscreen instructions (please make sure to read these carefully).

3 If the software needs registering, click the purple Register button, or follow the instructions on the left of the product page (again, please read these carefully). In some cases, you may need to register for a *PC Pro* software store account – if you don't already have one – and you might be prompted to reenter the coupon code on the spine or cover.

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pcprodownload.co.uk

*Codes are sometimes limited, so please claim early to avoid disappointment

HTC Vive Focus Vision

A top-quality headset for VR gaming on a PC, but when you're paying this much you deserve more

SCORE ★★★☆☆

PRICE £833 (£999 inc VAT)
from vive.com

I really wanted to love the HTC Vive Focus Vision, especially after my first few tests with *Half-Life: Alyx* and VR sim racing worked out so well. But after a few weeks with the headset, the relationship grew complicated. Let me explain.

After the first handful of sessions, I felt that what I'd heard about this headset from my friends in the industry may have been overly harsh. The build quality is great, with a lovely even weight distribution that feels fine on your head for hours and hours, which makes the hot-swappable batteries even more critical and impressive here.

Pair that with 5K display tech, stellar eye tracking with minimal latency, great all-round tracking and an ergonomic set of controllers, and you've got a good headset tailor-made for gaming. But this is where the story of the Vive Focus Vision starts to get murky.

When you see a standalone headset for £999, you expect the standalone aspect to shine. But there are problems here that stop it from being a high-end alternative to the Meta Quest 3 (*see issue 363, p64*) or a cheaper rival to the Apple Vision Pro (*see issue 355, p48*).

And now, when it comes to PC VR gaming, we have a new challenger in the PSVR 2, which just so happens to be the combo breaker of high-specced VR at an impressive price. It's a busy market where you absolutely need to be the best to stand out – especially at a thousand pounds. Still, there are some standout features here.

Glorious visuals

If you've got the right kind of gaming PC with the raw horsepower to drive super high-resolution visuals, the 5K LCD display with a 120° field of view can look glorious.

Whether it's dipping into the sim racing experience of *Assetto Corsa Competizione*, having a laugh in *Keep Talking and Nobody Explodes*, getting lost in the trippy imagery of *Tetris Effect* or shooting your way through *Half-Life: Alyx*, the sharpness and vivid colour of the HTC Vive Focus Vision's picture cannot be understated.

Nor can that field of view – the widest I've ever tested and something I didn't really think I'd appreciate as much as I did here. Seeing all the crispy details in my peripheral view adds to that immersion. What's more, the 5K resolution and 90Hz refresh rate (120Hz would have been even nicer) eliminates the screen door effect that has been prominent in headsets from this company.

But there's one major oddity here. I think everyone agrees that pancake lenses are absolutely the best way to go in VR right now – you don't get the chromatic aberration or light blooms caused by the circles imprinted on the glass. Meta knew this with the Quest 3, but had to opt for fresnel on the Quest 3S to cut costs.

So why am I seeing fresnel lenses on a headset of this price? The sharp picture does fight off some of the edge blurring, but the blooming is seemingly unavoidable in any games that play heavily on the contrast ratio. Out of the choices made for the Vive Focus Vision, this seems like the most baffling one.

ABOVE HTC has focused on comfort rather than a stylish design for style's sake

"If you've got of gaming PC with the raw horsepower to drive high-resolution visuals, the 5K LCD display can look glorious"

BELOW A resolution of 5K and the 120° field of view make for impressive visuals

Comfortable wear

If there's one thing HTC headsets have managed to do better than pretty much anyone else in the business, it's wearability. The Vive Focus Vision is no exception. Starting with the build quality – the aesthetic is much more utilitarian than its stylish rivals from Apple and Meta. Everything you see is where it is for a reason, and it all feels well put together without any creaking in the plastics when you adjust the headset on your face.

But the most important thing is that any VR headset is comfortable to wear, which the Vive Focus Vision absolutely is. If you wanted to stay immersed in a game for hours on end, you won't find any problems keeping this thing on, thanks to the balanced weight distribution between the tech up front and the battery pack round the back. Speaking of the battery, given it's hot-swappable, staying in the game is easier than ever.

With near latency-free eye tracking, hand tracking, high-resolution passthrough and two stellar controllers in terms of ergonomics, this is a great PC VR headset. It's the by-product of all the above coming together that makes it work.

On top of that, connectivity is simpler than you think with the additional streaming kit. Normally, it can be a mess of cables, but there's plenty of versatility here. Like the Meta Quest, there's a Streaming Cable you can use to plug directly into a VR-ready PC. And for that visually lossless connection for the pros, you can use the Wired Streaming Kit for DisplayPort connectivity.

There's also a wireless option, but you can expect a downgrade in visual fidelity carrying that data over the air. It does mean you could whip out the Roto VR chair, though, and I did have a lot of fun spinning on this throne playing *Half-Life*.

Beaten by Meta

So it's good for a PC VR headset, but once you start to peel back the layers, you start to notice the frustrations.

This is always going to be a problem with any headset that doesn't have the word Meta in its name. Yes, this headset is technically a standalone one – a hybrid that can switch quickly on the fly between PC VR and its own Android-based OS – but given the very limited selection of games you'll find on Viveport (with many being rather old), it doesn't feel standalone.

HTC has done work on its own front end: the OS is easy to navigate and it's simple to establish your boundaries with room-scanning (shout out to the full-colour passthrough). But there isn't really anything to do, so I found myself spending the vast majority of the time with this headset tethered to my PC.

Who knows? Maybe Android XR will change this in the future. But I can only go on what I have right now.

Outdated chipset

Why this doesn't have the Snapdragon XR2+ Gen 2 packed into it is beyond me. Instead, HTC uses the same chip found in the aged Meta Quest 2, namely the Snapdragon XR2. This means that, in the standalone VR experience, you can feel the system stress under the pressure of anything more than casual gaming or productivity tasks.

There is multitasking capability with the 12GB of onboard RAM, but I'm not sure whether it's a bottleneck of the chipset to that RAM or something else (maybe the graphics performance?) – something bothers this headset when you throw anything more intense at it. That's frustrating if you've just spent £999 on it.

BELOW The headset is comfortable to wear for long gaming sessions

Too many drawbacks

And that's the story of the HTC Vive Focus Vision. In many ways, it's one of the best PC VR headsets you can buy, packing an impressively crisp, colourful and smooth 5K screen, great tracking of eyes and hands, and an ergonomic design with hot-swappable batteries to keep you playing all day.

BELOW The two controllers are very well designed

But for £999, there are too many drawbacks. The limited app library and reliance on the older Snapdragon chipset means this isn't so great as a standalone experience. And fresnel lenses at this price are just unacceptable.

So when you think of this as a not-so standalone headset that requires a PC to take advantage of all it offers, you're in a world of other options such as the more cost-efficient PSVR 2 with all its OLED glory at a fraction of the price. By that point, this becomes hard to recommend to anyone outside of the PC VR elite. **JASON ENGLAND**

SPECIFICATIONS

Qualcomm Snapdragon XR2 Gen 2 processor • 12GB RAM • 128GB storage • microSD card reader (up to 2TB) • dual 2,448 x 2,448 90Hz IPS screens • up to 120° field of view • 2 x colour passthrough cameras • 4 x eye-tracking cameras • 2 x mics • integrated stereo speakers • removable battery • 2 x USB-C 3.2 Gen 1 ports (one with DisplayPort support) • Wi-Fi 6E • Bluetooth 5.2 • 2 x handheld controllers • 230 x 185 x 125mm (WDH) • 700g • 1yr warranty

Xreal One

Thinner frames and a new spatial processor make the Xreal One tempting despite the price

SCORE ★★★★☆

PRICE £374 (£449 inc VAT) from amazon.co.uk

Xreal's long-running family of augmented reality (AR) glasses has recently been joined by two new models, the Xreal One and the One Pro. They're quite similar, so we'll focus– if you'll pardon the expression – on the Xreal One, which costs £100 less than the Pro model.

The price is still £159 more than the mixed-reality Meta Quest 3S (*see issue 363, p64*), but this is a different type of headset. Unlike Meta's offering, the Xreal One isn't a standalone unit, but rather an add-on display for any device that supports HDMI or DisplayPort over USB Type-C.

Like most AR spectacles, the One looks like a pair of oversized sunglasses, with thick frames and side arms. The frame holds dual Sony micro-LED displays with an effective pixel density of 3,320ppi, firing down onto a triangular birdbath lens to create a 1080p screen with an expansive 32:9 aspect ratio.

The arms of the One include Bose-branded open-air speakers, and the left one features the USB-C port, which connects to your host device via a supplied cable. A red "X" button on the underside of the right arm brings up the main menu, where you can adjust the screen size, distance, brightness enhancement, colour temperature, interpupillary distance and more. A rocker switch adjusts the brightness of the display, or navigates up and down in the menu system, and a customisable black button on top of the right arm can be set to your preferred function.

The detachable front frame is a big upgrade over Xreal's previous glasses. It's made of thin, black plastic that snaps around the lenses, with interchangeable nose pads in small, medium and large sizes. It's easily removable and can be replaced with new frames in different colours and finishes to express your own style.

ABOVE The Xreal One are great for watching films as well as gaming

Another enhancement is an electrochromic dimming feature for the lenses. At the maximum setting it blocks out most ambient light, giving you a cinema-like experience with no need to attach physical light blockers, as with the older Air 2 glasses.

Perhaps the most significant change is inside. Xreal's new X1 spatial computing chip provides vastly improved movement tracking compared to earlier models. This is particularly noticeable in Anchor mode, where the virtual picture remains fixed in space when you move your head (the alternative being follow mode, where it follows your gaze). With the older Air 2 glasses there was visible lag when you turned your head, but now the One responds to even quick movements smartly and precisely.

LEFT The glasses are comfortable to wear thanks to a choice of nose pads

The Xreal One's USB connectivity means it will work with almost any device that supports an external display, be that a phone, laptop or gaming PC. My iPhone's home screen initially unhelpfully opened in portrait orientation, but turning the device into landscape mode rotated the content in my glasses. Video services such as YouTube or Disney+ default to landscape mode anyway, so it's easy to enjoy immersive multimedia content on the go.

Connecting to a computer is similarly easy, and the experience is quite impressive. I played *Guardians of the Galaxy* on my Windows PC for several hours with no eye strain or discomfort, and was even able to take advantage of the One's 120Hz refresh rate.

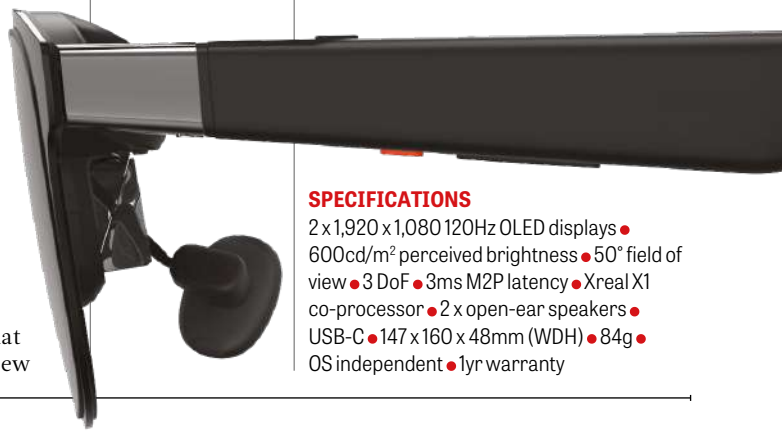
My biggest caveat here is that the One's horizontal field of view only extends to 50°; the One Pro broadens this to 57°, but either way it's still way less than the Meta Quest 3 and 3S, which offer 110° and 97° respectively. As a result, the edges of your display can get cut off, requiring you to physically turn your head from side to side to see everything. The solution is to increase the virtual viewing distance in the settings; I found four feet tended to clip content, but five feet was fine.

When I'd finished playing games, I decided to try kicking back and watching a film using the glasses. The virtual display can be scaled up to an enormous 191 inches, and it was a joy to sprawl out on my couch and enjoy *Deadpool & Wolverine*, especially with the dimming feature blocking out the room light. The sound quality impressed me, too: normally I use earbuds when watching movies or playing games with AR glasses, but the One's speakers are so good, with so much bass and dynamic range, that it simply wasn't necessary.

"Xreal's new X1 spatial computing chip provides vastly improved movement tracking compared to earlier models"

The Xreal One won't be right for everyone. It needs to be driven by a wired host, and the limited field of view makes it less than wholly immersive. If you're looking for a self-contained VR experience, a cheaper Meta Quest headset will be more up your street.

Within its own market, however, the Xreal One is a winner. It offers a slim, customisable frame, a stylish aesthetic and some significant technical improvements over previous models. It's excellent for consuming content while travelling – or simply lounging around the house in front of a huge virtual display – and there's also the promise of future add-ons, including an upcoming snap-on camera for taking photos or recording videos. **BRANDON HILL**



BELOW The slim, stylish frame contains Bose-branded open-air speakers

SPECIFICATIONS

2 x 1,920 x 1,080 120Hz OLED displays • 600cd/m² perceived brightness • 50° field of view • 3 DoF • 3ms M2P latency • Xreal X1 co-processor • 2 x open-ear speakers • USB-C • 147 x 160 x 48mm (WDH) • 84g • OS independent • 1yr warranty

palicomp

01270 898 104
sales@palicomp.co.uk

pro-series

mid [PRO1]

£449.99

CPU	AMD RYZEN 5 8500G
Core	6 Cores - 12 Threads
Clock	(3.5/5Ghz Turbo)
Mob	ASUS TUF A620M-PLUS WIFI
RAM	ADATA 16GB DDR5 5600Mhz
M.2	TRANSCEND 1TB M.2 nVME
GPU	AMD RADEON Graphics
Case	KOLINK Observatory HF MESH
O/S	*NO OPERATING SYSTEM*
PSU	BUILDER 500W PSU

Max [PRO2]

£979.99

CPU	AMD RYZEN 5 7600X
Core	6 Cores - 12 Threads
Clock	(4.7/5.3Ghz Turbo)
Mob	ASUS PRIME B650M-A WIFI II
RAM	ADATA 32GB DDR5 5600Mhz
M.2	TRANSCEND 1TB M.2 nVME
GPU	NVIDIA RTX4060 TI 16GB
Case	1stPlayer D3-A aRGB - Black
O/S	*NO OPERATING SYSTEM*
PSU	CIT 700W PSU

UBER [PRO3]

£1159.99

CPU	INTEL Core i5 14600K
Core	14 Cores - 20 Threads
Clock	(2.6/5.3Ghz Turbo)
Mob	ASUS B760M-K
RAM	ADATA 32GB DDR5 5600Mhz
M.2	ADATA 2TB S70 Blade M.2 nVME
GPU	NVIDIA RTX4060 TI 16GB
Case	GAMEMAX F15M MESH
O/S	*NO OPERATING SYSTEM*
PSU	BEQUIET 850W Gold PSU

Aurora RANGE

i3 Aurora [AUR1]

£629.99

CPU	INTEL Core i3 14100F
Core	4 Cores - 8 Threads
Clock	(3.5/4.7GHz)
Mob	ASUS B760M-K
RAM	ADATA 16GB DDR5 5600Mhz
M.2	TRANSCEND 1TB M.2 nVME
GPU	NVIDIA RTX3050 8GB
Case	GAMEMAX Abyss Mini RGB
O/S	MICROSOFT Windows 10/11
PSU	CIT 600W Bronze PSU

i5 Aurora [AUR2]

£999.99

CPU	INTEL i5 14400F
Core	10 Cores - 16 Threads
Clock	(Turbo 4.7Ghz)
Mob	ASUS B760M-K
RAM	CORSAIR 32GB DDR5 6000Mhz
M.2	ADATA 2TB M.2 NVMe
GPU	NVIDIA RTX4060 8GB
Case	CORSAIR iCUE 4000X
O/S	MICROSOFT Windows 10/11
PSU	CORSAIR 650W PSU

i7 Aurora [AUR3]

£1599.99

CPU	INTEL Core i7 14700KF
Core	20 Cores - 28 Threads
Clock	(3.4/5.6Ghz Turbo)
Mob	ASUS PRIME Z790-P WIFI - DDR5
RAM	CORSAIR 32GB DDR5 6000Mhz
M.2	ADATA 1TB S70 Blade M.2 nVME
GPU	NVIDIA RTX4070 12GB
Case	CORSAIR iCUE 4000X RGB
O/S	MICROSOFT Windows 10/11
PSU	CORSAIR 650W Gold PSU

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OnePlus 13

If you're after the best-value flagship phone you can get, this superb all-rounder is the answer

PC PRO RECOMMENDED

SCORE ★★★★★

PRICE 12GB/256GB, £749 (£899 inc VAT) from oneplus.com/uk

The number 13 may be unlucky for some, but the OnePlus 13 has plenty of blessings, including a great screen, powerful processor, long battery life and fast recharging. You could even say it sets the standard for 2025 smartphones, having been launched in the first week of the year.

The price is higher than last year's OnePlus 12 (*see issue 354, p60*): you'll now pay £899 for the phone with 12GB RAM and 256GB of storage, or £999 for the 16GB/512GB version. That's still less than other high-end, big-screen phones such as Samsung's Galaxy S24 Ultra (*see issue 354, p58*) or the Pixel 9 Pro XL (*see issue 362, p58*) – especially if you're looking for maxed-out memory and storage.

New look

The design has changed from the previous model. The sides are flatter, but the display is still curved on all sides, helping the phone nestle in your hand however you hold it. At the back, OnePlus has trimmed the metal backing from the camera block and added a smart glossy line across the body of the phone. The front is now clad in Ceramic Guard material to prevent cracks and scratches, and the phone gains IP69 water and dust resistance, meaning it should survive total immersion in water, or even being sprayed by a high-pressure jet.

The trim options have been freshened up, too, with the familiar black and green casings replaced by three new finishes. I tried the Arctic Dawn version, a whitish-silver model with an anti-fingerprint matte texture; also available are Black Eclipse, which supposedly feels like wood, and the vegan leather Midnight Ocean Blue, which is thicker but lighter than the glass-backed options.

Screen refresh

As before, the OnePlus 13 uses a 6.8in OLED screen with a refresh rate that scales automatically between 1Hz and 120Hz. What's new is LTPO 4.1, which allows the display to set two different refresh rates in different screen zones, to save more power when only a part of the screen is moving.

The display looks great, as OLED usually does. It scored extremely well in our colour reproduction tests, and beat its rivals for colour accuracy. Its peak brightness measurement was lower than the competition's, but that tells only part of the story: OnePlus' new "RadiantView" technology dynamically adjusts localised brightness (as well as colour and contrast) for optimum readability. Consequently, while the numbers suggest the OnePlus 13 is only half as bright as the Pixel 9 Pro XL, I actually found it just as easy to read in bright daylight. However, if you're contending with concentrated light sources such as a powerful ceiling spotlight, the anti-glare coating of the Galaxy S24 Ultra still comes out on top.

LEFT An IP69 rating means the phone is well protected from dust and water

ABOVE The OnePlus 13 brings flagship features at a much lower price than rivals

Another interesting display feature is the new Glove Mode. The OnePlus 12 introduced Aqua Touch, which helps keep the screen usable when wet; now the OnePlus 13 works better when you're wearing gloves. This is a great idea for cold weather, but OnePlus says it will only work with woollen or sheepskin gloves under 0.5cm thick, and even then I found I had to make an effort to make big, clear gestures and taps. Still, it's better than nothing.

One final hardware upgrade is the new under-display fingerprint scanner, whose ultrasonic sensor is faster and more reliable than the optical sensors in previous OnePlus phones. Mind you, the company is playing catch-up here, as Samsung has already been using this technology for more than five years.

"LTPO 4.1 allows the display to set two different refresh rates in different screen zones, to save more power"

High-res cameras

Like previous models, the OnePlus 13's camera module is Hasselblad-branded, and the main ultrawide and 3x telephoto cameras now all use high-resolution 50MP sensors. I took a whole load of photos with each and found the results held up very well against the best rival phone cameras. Street scenes captured looked brighter and sharper than the same shots taken on an iPhone 16 Pro Max (*see issue 363, p72*), while the image from the Google Pixel 9 Pro XL looked dull and lifeless by comparison.

I was happy with night shots. Again, the OnePlus brightened the scene a lot, but kept big light sources such as fairy lights nicely controlled, squeezing out more detail as a result. The Pixel's signature Night Sight mode produced a more natural-looking image overall, but with worse bloom from the lights. The 32MP front sensor takes great selfies in all conditions, too. Based on my experiences, OnePlus has earned a place alongside Apple, Google and Samsung in the top tier of smartphone photography.

Power on tap

The OnePlus 13 features the latest Snapdragon 8 Elite chip, giving it enough power to go head to head with more or less any phone on the market. The OnePlus placed a little behind the Asus ROG Phone 9 Pro (*see issue 365, p72*) in our benchmarks, thanks to its high-performance "X Mode", but it mostly beat the Galaxy S24 Ultra and Pixel 9 Pro XL, and gave the iPhone 16 Pro Max a good run too, only falling short on the transcoding and single-core CPU performance metrics.

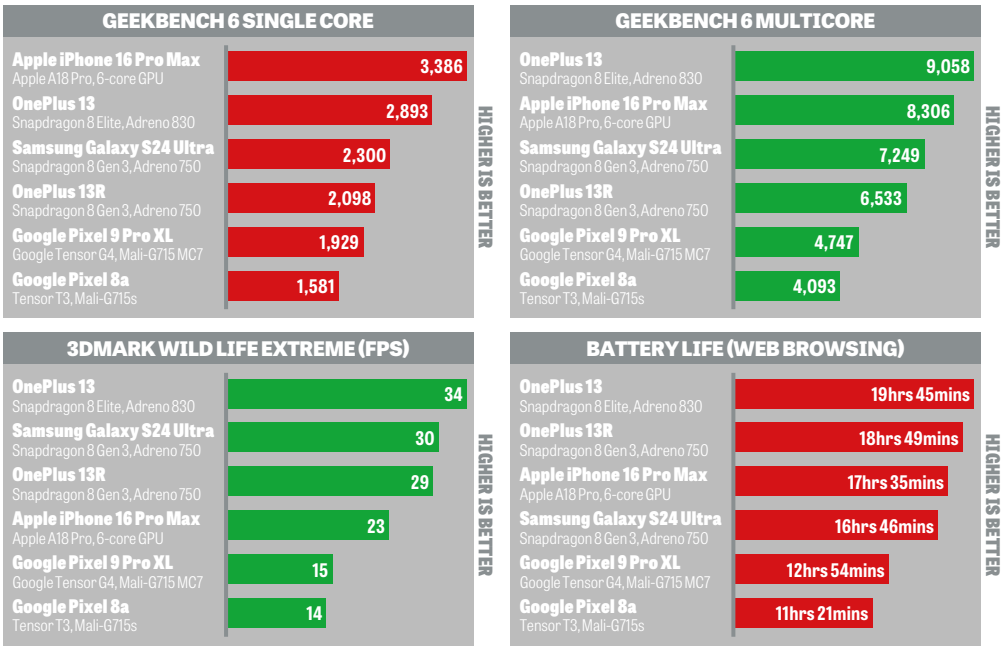
Consequently, everything you do on this phone feels fluid and instant. Even gaming performance is admirable: admittedly it can't run mobile RPG *Ex Astris* at full settings without hiccups, but performance is generally smooth as you run around the game world or fight enemies in flashy battles.

Brilliant battery

There's also good news on the battery front. OnePlus is known for equipping its phones with extra-large batteries, and the 6,000mAh unit inside the OnePlus 13 kept it ticking for 19hrs 45mins in our web-browsing test. That's seven hours longer than the Google Pixel 9 Pro XL, three hours longer than the Samsung Galaxy S24 Ultra and more than two hours of extra juice compared to the iPhone 16 Pro Max. As with the processor, this phone can't quite match the overachieving Asus ROG Phone 9 Pro, which managed 20hrs 34mins, but this is still an excellent result.

The other thing OnePlus is known for is lightning-fast charging. The phone supports OnePlus' 100W "Supervooc" charger, which the company claims will refill the battery from dead to 100% charge in a little over 35 minutes. I tried the 80W model and was pleased to see the phone fill up to 56% in 15 minutes and to 92% in half an hour. There's no charger in the box, though; budget for around £30 extra if you want one of these high-speed chargers.

Wireless charging has been upgraded, too: with a compatible pad you can recharge wirelessly at up to 50W, and OnePlus has introduced a magnetic wireless puck that snaps conveniently onto the back for strong, reliable charging. Curiously, though, the OnePlus 13 itself isn't magnetic, so you'll need to pop it into a suitable case to make the charger stay in place. First-party offerings start at £25.



Software updates

The OxygenOS 15 system software is based on Android 15 and has all the features you'd expect from a premium Android phone, including the inevitable AI suite. This contains tools for live translation, transcription, text generation and formatting, plus image editing and enhancement; there's also an Intelligent Search tool that can hunt for content within local files (except in hidden folders), along with Google's Circle to Search tool and Gemini assistant.

Another interesting addition to OnePlus' software is the Share with iPhone tool, as previously seen on the Oppo Find X8 Pro. This lets you beam files wirelessly between an iPhone and the OnePlus 13, and although it does require you to install the companion app on the iPhone it generally works very well – it's the closest thing we've seen to a cross-platform AirDrop equivalent.

I also have to mention BeaconLink, a walkie-talkie mode that lets you make calls to other OnePlus phones over Bluetooth in a 200m range. Honestly, it's hard to think of a situation where a standard call wouldn't work just as well, but there's no harm in having the option.

And you can look forward to more features arriving in future, as OnePlus promises four years of full Android updates and six years of security updates. That's a year more than the OnePlus 12 got, and while it's not as long as the seven years that Google and Samsung offer for their flagship phones, it could well see you through until your next upgrade.

"Based on my experiences, OnePlus has earned a place alongside Apple, Google and Samsung in the top tier of smartphone photography"

BELOW The three 50MP cameras on the rear are a match for the best phone lenses

Many pluses

In all, the OnePlus 13 is a great phone at a compelling price. Its closest competitors all cost more, and mostly come with less storage, shorter battery lives and slower charging. If there's a catch, it's the timing: as I write this, Samsung is preparing to reveal its new range of Galaxy S25 smartphones, which will doubtless divert the spotlight from OnePlus. But even if new rivals match the OnePlus 13 on specs or beat it for photographic quality or raw performance, I very much doubt they'll challenge it for all-round value. Pound-for-pound this is one of the best phones around, and that's not likely to change any time soon.

RICHARD PRIDAY

SPECIFICATIONS

8-core Snapdragon 8 Elite SoC • 12GB/16GB RAM • Adreno 830 graphics • 6.8in 120Hz AMOLED screen, 1,440 x 3,168 resolution • 5G • 256GB/512GB storage • dual nano-SIM • IP68 • triple 50MP/50MP/50MP rear cameras • 32MP front camera • Wi-Fi 7 • Bluetooth 5.4 • NFC • 6,000mAh battery • USB-C 3.2 Gen 2 connector • Android 15 with OxygenOS 15 (4 major updates) • 77 x 8.5 x 163mm (WDH) • 210g • 1yr warranty

OnePlus 13R

Not as cheap as the Pixel 8a, but battery life and overall performance make it a strong choice at this price

SCORE ★★★★☆

PRICE 12GB/256GB, £566 (£679 inc VAT) from oneplus.com

The OnePlus 13R offers much of the same character as the OnePlus 13 (*see p72*), but for £220 less. You still get a 6.8in screen, the same 12GB of RAM and 256GB of storage, and they even look similar: its aluminium frame comes in silver "Astral Trail" or black "Nebula Noir", with Corning's Gorilla Glass 7i for protection against scratches. An IP64 rating means it can handle splashes, too, though you can't dunk the phone in water or blast it with high-pressure water jets like you can the OnePlus 13.

While the OnePlus 13R's display is just as big as the 13's, it has a lower 1,264 x 2,780 resolution. That's still sharp (it works out to 449ppi), and the adaptive refresh rate scales dynamically from 1Hz to 120Hz. It's bright, too – I had no problem watching films in direct sunlight – and colour performance is impressive, with 172% sRGB coverage in its default Vivid mode and 122% of the wider DCI-P3 colour gamut. In all it's a very good-looking screen, and while the under-display fingerprint sensor is optical rather than ultrasonic I found it responsive enough to use as my primary way of unlocking the phone. There's face recognition, too.

The OnePlus 13R may not have the Hasselblad-branded photographic hardware of the 13, but it's still well equipped with a 50MP main and 2x telephoto cameras, plus an 8MP ultrawide shooter. The results are attractive, but only if you like bold, lively colours.

In fact, the processed images often looked more exciting than the actual scene, often emphasising colour at the expense of detail. I took a 2x telephoto shot of a monument in a park, and while the image looked great at first glance, zooming in revealed that the text on the plaque was smeary, while Google's Pixel 8a produced a cleaner result. On the plus side, whatever digital zoom algorithm OnePlus is using is clearly on point: 4x zoom shots came out impressively sharp.

The ultrawide lens also performed admirably when I captured an expansive scene of a bridge across the river; once again, it delivered a bright, colourful image, next to which results from the Pixel 8a (*see issue 358, p74*) looked rather flat.

The OnePlus 13R uses a Snapdragon 8 Gen 3 SoC, which powered many of last year's flagship Android phones. While not as fast as the latest Snapdragon Elite silicon, it's still powerful enough for almost anything you might want to do, including gaming. In 3DMark Wild Life Unlimited, the 13R averaged 115fps, well ahead of other phones in its class such as 87fps from the Samsung Galaxy S24 FE (*see issue 363, p76*) and 51fps for the Pixel 8a. The phone became warm when I tested a bunch of AI features before leaping into a lengthy gaming session, but performance never stuttered.

ABOVE The 13R has much in common with the more expensive OnePlus 13 on p72

The OnePlus 13R also benefits from an enormous 6,000mAh battery, which gave me 18hrs 49mins of web surfing before running out of power. That's way ahead of competing phones: the Google Pixel 8a lasted 11hrs 21mins in the same test, while the Samsung Galaxy S24 FE held out for 11hrs 38mins. There's no wireless charging, but wired charging is supported at up to 80W; a 55W adapter took me from empty to 60% in 30 minutes – not bad at all.

Needless to say, the software includes various AI capabilities: OnePlus' Intelligent Search feature quickly tracked down a document I had stored on the phone, and there's a suite of AI-powered photo-editing tools, too, including a Reflection Eraser for cleaning up shots taken through a window and an AI Eraser for completely removing unwanted elements. The handy Compare button lets you instantly review before and after versions of your edited images, to see what the AI tools have done.

In a few ways, though, the AI features feel unrefined. I wish it were easier to tell which of your photos had been AI-edited, without digging into the details of each one, and I was annoyed that the AI Notes app rewrote my text in a tone that sounded nothing like my voice. Still, OnePlus promises four years of software updates, so hopefully these features will be improved in future.

"By the traditional metrics of camera, performance and display, the OnePlus 13R is a brilliant all-rounder for a very reasonable price"

LEFT The bright, sharp screen displays colours accurately

The OnePlus 13R is around £100 more expensive than the 256GB Pixel 8a, and £55 more than the 256GB Galaxy S24 FE. Right now, both rivals offer slicker AI services, but by the traditional metrics of camera, performance and display, the OnePlus 13R is a brilliant all-rounder for a very reasonable price. **PHILIP MICHAELS**

BELOW An aluminium frame provides protection against dust and water

SPECIFICATIONS

8-core Qualcomm Snapdragon 8 Gen 3 SoC • 12GB RAM • Adreno 750 graphics • 6.8in 120Hz AMOLED screen, 1,264 x 2,780 resolution • 5G • 256GB storage • dual nano-SIM • IP65 • triple 50MP/50MP/8MP rear cameras • 16MP front camera • Wi-Fi 7 • Bluetooth 5.4 • NFC • 6,000mAh battery • USB-C 2 connector • Android 14 (4 major updates) • 76 x 8 x 162mm (WDH) • 206g • 1yr RTB warranty

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Amazon Echo Show 21

Amazon's biggest and fastest smart display, with Wi-Fi 6E and the built-in Fire TV adding to its allure

PC PRO RECOMMENDED

SCORE ★★★★☆

PRICE £333 (£400 inc VAT) from amazon.co.uk

The Echo Show 21 is by far the largest Alexa device Amazon has ever made, and it's also the most expensive. But you get much more than a simple voice assistant. It's a smart, always-on display for checking upcoming appointments, shopping lists, the weather forecast and more at a glance; it can monitor and control a huge range of smart-home appliances using Matter, Thread and Zigbee platforms; and it doubles as a Fire TV for streaming movies and TV programmes, with a voice remote and wall mount included in the box. You can also plonk it on a desk or kitchen counter, though the optional stand costs an extra £100 inc VAT.

This isn't Amazon's first attempt at a big-screen Echo. In 2022 we tested the first-generation Echo Show 15 (*see issue 330, p70*) and found it a generally agreeable smart-home hub. The experience of using the Echo Show 21 is similar, with notable upgrades that might win over those who weren't persuaded by the original model.

The most visible enhancement is the larger screen. The name slightly undersells the display size, which measures 21.5in across the diagonal, making all other Echo devices look tiny in comparison. The Full HD 1080p resolution is sharp, especially since this isn't a screen that's intended for up-close document work – it's more for popping up reminders, displaying photos or watching films and shows, and for those purposes it looks great. The text in widgets is easy to read, and I really enjoyed catching up on TV shows or watching YouTube clips.

ABOVE Amazon's Echo Show 21 is far more than a simple voice assistant

As well as great visuals, the Echo Show 21 has surprisingly good audio. With the volume turned up halfway, the Echo Show 21 filled my kitchen with sound, with dual 2in woofers providing solid and rich-sounding bass – so it's ideal not only for video, but for music and radio services, too.

"It's a smart, always-on display; it can control a huge range of smart-home appliances; and it doubles as a Fire TV"

Smooth operator

Internally, the Echo Show 21 is powered by a custom eight-core SoC, which makes everything feel fast and snappy. When testing previous Echo Show devices I've noticed occasional delays and stutters, but with this smart display it was a perfectly smooth experience throughout.

Another thing that helps the Echo Show 21 feel fast is its support for Wi-Fi 6E. When partnered with a compatible router, this allows it to fetch information from the internet at tremendous speeds. For example, on the original Echo Show 15 I saw an

LEFT The 21.5in Full HD display is great for watching films and TV shows

average download rate of 128Mbits/sec, but with the Echo Show 21 that rocketed up to 304Mbits/sec.

There are a few subtle design changes from the Echo Show 15. The front-facing camera has moved from the left to the centre of the frame. This looks more natural when you're using it – when not in use you can hide it away behind a shutter – and it works better for video calls. The camera has a 13MP sensor with a wide field of view, which works well for group photos or video calls with multiple people in the room. For one-on-one meetings, digital pan and zoom capabilities follow you around the room automatically, with a zoom factor of up to 3.3x. As with other Echo Show devices, when you're not using the camera, the device can use facial recognition to identify who's standing in front of it and bring up their preferred widget content.

Room with a view

There's one other trick to the camera, too: when the Echo Show 21 is idle you can use it to keep an eye on your home. With the device mounted on my kitchen wall, I could open up the Alexa app from anywhere and get a live view right across my kitchen and into the living room. You can also view the camera feed from other Alexa-equipped smart displays, and even listen in on the microphones.

I do have some gripes. One of my biggest complaints about the Echo Show 15 hasn't been fixed, and that's the limited selection of home-screen widgets. The ones you do get are generally good: Amazon's first-party widgets provide handy updates on the weather, your calendar, your commute and so forth. It's also nice to walk up to the screen and directly control other smart-home devices. Beyond that, though, there's little in the way of inventive or fun widgets, from either Amazon or third parties.

The widget interface doesn't take full advantage of the big screen of the Echo Show 21, either. Next to the jumbo-sized main panel you can configure one wide widget and six mini displays – but there are only seven wide-format widgets to choose from, and you can't use two at once. This frustrated me, as I would have loved to have the wide calendar and appointment view on display, plus the full-sized smart-home control panel. Instead, I had to use the compact version of the latter, and miss out on the full set of touchscreen controls.

Another curious limitation is that, while most major streaming services are accessible through the Fire TV interface, there's no direct support for BBC iPlayer. This doesn't mean you can't watch BBC programmes, but you have to adopt a clunky workaround of going into the Silk Browser app and using the iPlayer web interface. You can't cast content to the Echo Show 21 from other devices as you can with a regular Fire TV device, either, and there's no video input socket for external sources.

Finally, while the optional metal stand feels nicely solid, it's not as flexible as I would have liked. Although it can rotate through 360 degrees and tilt up and down, for the price I would have liked height adjustment, too.

Generational difference

Despite those shortcomings, I found the Echo Show 21 a very likeable upgrade from the older Echo Show 15. Part of me always wished the original model had a larger screen, so in that regard it feels as if Amazon read my mind. More than this, I was pleasantly surprised by how easy it was to upgrade from one to the other: the Echo Show 21 uses the same power adapter and wall mount as the 15in version, so I was able to take the smaller smart display down and replace it with the larger model in less than five minutes. I did have to pair the included remote and go through the initial setup process, but it was still one of the simplest smart home upgrades I've ever done.

ABOVE The Echo Show 21 can be easily mounted on a wall

Even if you aren't upgrading from the Echo Show 15 to the Echo Show 21, you can easily swap from one to the other if you find that the Echo Show 21's larger screen is too big for your space.

Worth the price?

For many people, the biggest issue with the Echo Show 21 will be the price. It's £100 more than the 15in model (see below), and if you're on a tight budget you could even opt for the wall-mounted Echo Hub at only £170, although it's a lot smaller at 8in. Of course, the Echo Show 21 serves double duty as an entertainment station, but it's questionable how well that really meshes with the live information display and smart home hub roles.

"While the price may be a reach, you're really getting a lot of capabilities – and you don't have to pay extra for a wall mount or a remote"

Still, the Echo Show 21 is an undeniably impressive device, addressing many of my reservations about Amazon's original wall-mountable smart display. Its big screen allows you to pin a wide selection of home-screen widgets, and makes it a perfectly viable device for streaming TV shows and movies, as well as listening to music and audio services through those upgraded speakers.

Other welcome improvements include the enhanced camera and tracking capabilities, allowing for better video calls, group pictures and home monitoring, while the new CPU and Wi-Fi hardware make for a faster experience overall. So while the price may be a reach, you're getting a lot of capabilities in return. While not as versatile as you might hope, the Echo Show 21 is a striking, high-quality and neatly integrated upgrade for any kitchen. **ANTHONY SPADAFORA**

SPECIFICATIONS

21.5in 1,920 x 1,080 IPS touchscreen • 8-core SoC with Amazon AZ2 neural network engine • 2 x 2in woofers • 2 x 0.6in tweeters • 13MP camera • Wi-Fi 6E • Bluetooth (A2DP and AVRCP) • 540 x 38 x 340mm (WDH) • 4.9kg • remote control • 1yr limited warranty

ECHO SHOW 15

For those seeking something cheaper and less imposing than the Echo Show 21, Amazon has also updated the 15in model with most of the same features. The smaller smart display uses the same latest-generation CPU as the 21in version, with the same camera and smart-home capabilities, plus Fire TV support and a bundled remote.

The main difference – aside from the physical size – is the home screen. The Echo Show 15 matches the 1080p resolution of the plus-size version, but to keep things readable it uses larger widgets: you get one main display, taking up half of the screen space, plus one wide widget and three smaller panels. If that's enough for your home it's a more economical choice at £300 inc VAT, although the adjustable stand is still an extra £100 on top.

THE SUITE SPOT

BEST SECURITY SUITES VS BEST FREE ANTIVIRUS

With so many excellent choices for free antivirus protection, the real question becomes whether it's worth paying for any of the full suites

When it comes to virus protection, you've never had it so good. All of the products on test here provide strong defences against real-world attacks, and that includes the built-in protection from Windows Defender (although it was the weakest on test).

So why pay for a security suite? You certainly don't need to if you're only worried about malware, but the clue comes in the name: if you want a suite of tools to protect your security, and your privacy, then there are strong arguments to buy an all-in-one package rather than going separately.

We're particularly thinking about VPN software. While we will always tell you to buy a specialist tool if you have advanced needs, a security suite is a cost-effective way to add this privacy tool to your armoury. But choose wisely and you'll also enjoy additional protection against ransomware attacks, device management tools that allow you to track/kill lost or stolen devices, and cloud backup.

The more expensive suites also bring identity protection into the equation. Several of these suites will monitor the dark web to see if your details are being sold online, and McAfee will even step in and act on your behalf. Albeit for a price that's built into the suite.

As always, don't be lured in by low first-year prices. It's the renewal cost that really matters, which is why we hunt out the best price for retail licences wherever possible. We hope the end result is a Labs that helps you choose the best buy for your needs – and keeps you safe in 2025 and beyond.

CONTRIBUTOR: KG Orphanides

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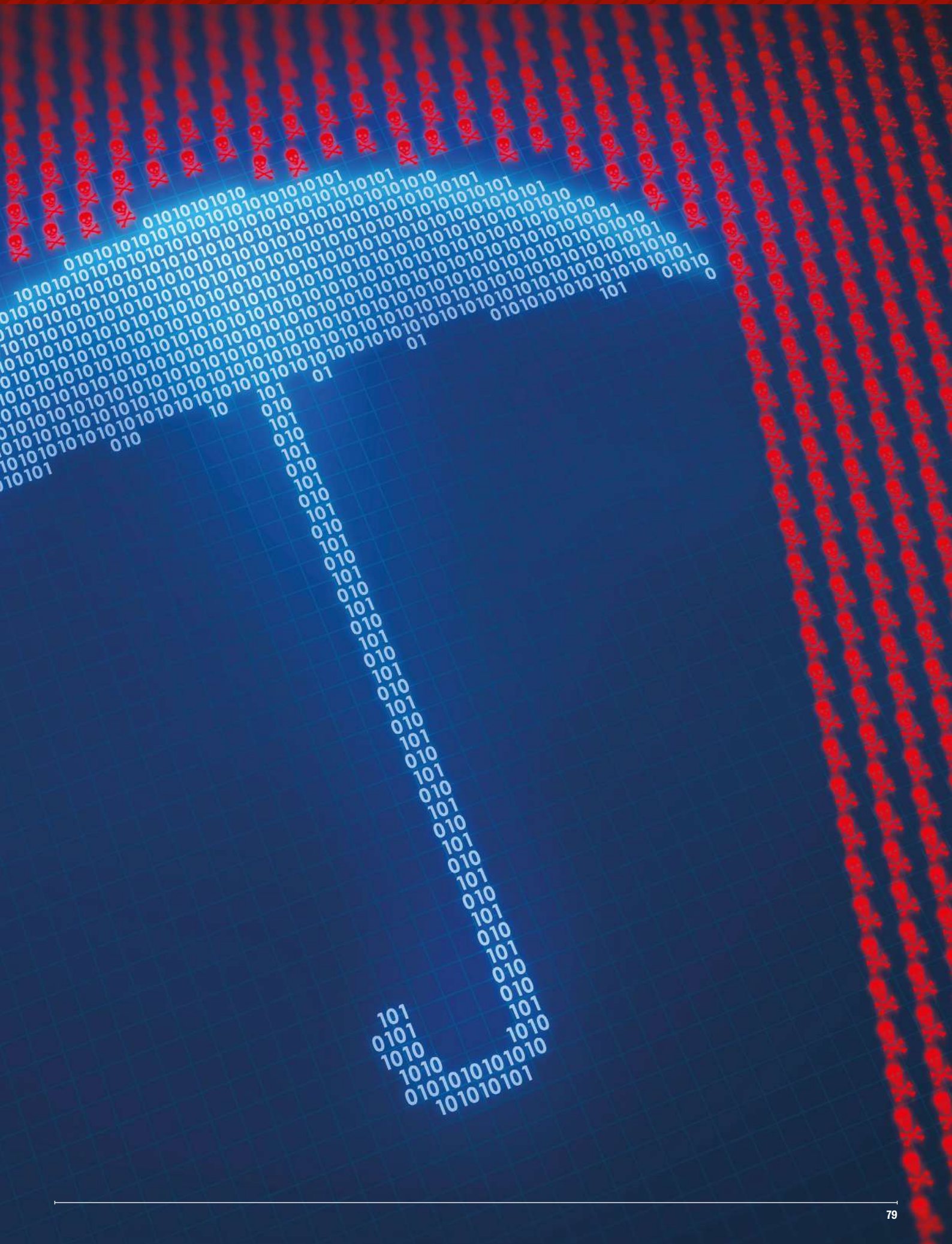


		LABS WINNER	RECOMMENDED			
	Avast Ultimate	**Avira Prime**	**Bitdefender Total Security**	**Eset Home Security Ultimate**	**F-Secure Total**	**G Data Total Security**
Overall	★★★★½	★★★★★	★★★★½	★★★★½	★★★★½	★★★★½
Website	avast.com	avira.com	bitdefender.co.uk	eset.com	f-secure.com	gdatasoftware.co.uk
Desktop clients	macOS, Windows	macOS, Windows	macOS, Windows	macOS, Windows	macOS, Windows	macOS, Windows
Mobile clients	Android, iOS	Android, iOS	Android, iOS	Android, iOS	Android, iOS	Android, iOS
Pricing						
First year's price direct	1 PC, £42 (£50 inc VAT); 10 devices, £58 (£70 inc VAT)	5 devices, £43 (£52 inc VAT)	5 devices, £42 (£50 inc VAT)	5 devices, £64 (£77 inc VAT)	5 devices, £83 (£100 inc VAT)	5 devices, $68 ($82 inc VAT)
Renewal price direct	1 PC, £92 (£110 inc VAT); 10 devices, £117 (£140 inc VAT)	5 devices, £76 (£91 inc VAT)	5 devices, £63 (£75 inc VAT)	5 devices, £96 (£115 inc VAT)	5 devices, £83 (£100 inc VAT)	5 devices, $68 ($82 inc VAT)
Third-party retail price	10 devices, 2yrs, £25 (£30 inc VAT) from store.pcpro.co.uk	Not available (Avira Internet Security for 3 devices costs £30 inc VAT from Amazon)	5 devices, 1yr, £17 (£20 inc VAT) from store.pcpro.co.uk	5 devices, 1yr, £67 (£80 inc VAT) from amazon.co.uk	N/A	5 devices, 1yr, £60 (72 inc VAT) from amazon.co.uk
Features						
Firewall	✓	✓	✓	✓	✗	✓
Browser protection: link checking or site blocking	✓	✓	✓	✓	✓	✓
Ransomware protection (dedicated module)	✓	✗	✓	✓	✓	✓
Cloud backup	✗	✗	✗	✗	✗	✗ (local backup tool included)
Webcam protection (dedicated module)	✗	✗	✓	✓	✗	✗
VPN	✓	✓	✓	✓	✓	✗
Password manager	✗	✓	✗	✓	✓	✓
Scheduled scans?	✓	✓	✓	✓	✓	✓
Silent detection mode	✓	✓	✓	✓	✓	✓
Parental controls	✗	✗	✓	✓	✓	✓
Device management/ tracking	Mobile only	✗	✓	✓	✓	✗
Bootable rescue disk	✗	✓	✗	✓ (free download)	✗	✓ (built into app)
Breach monitoring	✓	✓	✗	✗	✓	✗
Data broker removal service	✗	✗	✗	✗	✗	✗
Identity theft/lost wallet support	✗	✗	✗	✗	✓	✗
Test results						
AV-Test Real-world (batch 1)	100%	100%	100%	100%	100%	100%
AV-Test Real-world (batch 2)	100%	100%	100%	100%	100%	100%
AV-Test Reference (batch 1)	100%	100%	100%	100%	100%	100%
AV-Test Reference (batch 2)	100%	100%	100%	100%	100%	100%
AV-Test false positives (total)	1	0	0	0	0	2
AV-Test protection score	6	6	6	6	6	6
AV-Test performance score	6	6	5.5	6	5.5	6
AV-Test usability score	6	6	6	6	6	6
AV-Comparatives Real-World Protection – % blocked	99.6%	99.8%	99.6%	99.2%	99.8%	99.6%
AV-Comparatives Real-World Protection – false positives	13	7	5	3	45	17
SE Labs Protection rating	100%	N/A	N/A	N/A	N/A	N/A
SE Labs Legitimate Accuracy	100%	N/A	N/A	N/A	N/A	N/A
SE Labs Total Accuracy rating	100%	N/A	N/A	N/A	N/A	N/A

	K7 Ultimate Security	McAfee+ Ultimate	Microsoft Defender Antivirus	Norton 360 Deluxe	RECOMMENDED Sophos Home Premium	TotalAV Antivirus Pro
	★★☆☆☆	★★★★☆	★★★★☆	★★★★☆	★★★★★	★★★☆☆
	k7computing.com	mcafee.com	microsoft.com	uk.norton.com	home.sophos.com	totalav.com
	macOS, Windows	macOS, Windows	macOS, Windows	macOS, Windows	macOS, Windows	macOS, Windows
	Android, iOS	Android, iOS	✗	Android	✗	Android, iOS
	5 devices, £31 (£37 inc VAT)	Individual, unlimited devices, £142 (£170 inc VAT); Family, unlimited devices, £217 (£260 inc VAT)	Free to Windows users	5 devices, £25 (£30 inc VAT)	10 devices, £31 (£37 inc VAT)	5 devices, £24 (£29 inc VAT)
	5 devices, £53 (£63 inc VAT)	Individual, unlimited devices, £191 (£230 inc VAT); Family, unlimited devices, £292 (£350 inc VAT)	Free to Windows users	5 devices, £75 (£90 inc VAT)	10 devices, £42 (£50 inc VAT)	5 devices, £83 (£99 inc VAT)
	N/A	Not available (Total Protection – 10 devices, 15 months – costs £15 inc VAT from Amazon)	N/A	Not available (Norton 360 Advanced – 10 devices, 2yrs – costs £20 inc VAT from store.pcpro.co.uk)	N/A	N/A
	✓	✓	✓	✓	✗	✗
	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✗ (cloud backup service)	✓	✓
	✗	✗	5GB (OneDrive)	✓ (50GB)	✗	✓ (2GB)
	✓	✓	✗	✓	✓	✗
	✗	✓	✗	✓	✗	✗
	✗	✓	✓ (via Microsoft Authenticator)	✓	✗	✗
	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓
	✓	Family only	✓	✓	✓ (web filtering)	✗
	✗	✓	✓	✓	✓ (management and remote scanning)	✗
	✗	✗	✗	✓ (free download)	✗	✗
	✗	✓	✗	✓	✗	✓
	✗	✓	✗	✗	✗	✗
	✗	✓	✗	✓	✗	✗
	100%	100%	100%	100%	N/A	100%
	100%	100%	99%	100%	N/A	100%
	100%	100%	100%	100%	N/A	100%
	100%	100%	100%	100%	N/A	100%
	2	2	2	1	N/A	0
	6	6	6	6	N/A	6
	5.5	6	6	5.5	N/A	5.5
	6	5.5	6	6	N/A	6
	N/A	99.8%	98.3%	99.8%	N/A	98.7%
	N/A	10	3	22	N/A	5
	N/A	98%	98%	100%	99%	N/A
	N/A	100%	100%	100%	100%	N/A
	N/A	99%	99%	100%	100%	N/A

Security suites vs free antivirus: how to decide

The great thing about internet security software is that it's easy to try before you buy – and if you're after simple protection, there's no need to spend a penny

When it comes to choosing security software, there's one thing that can't be ignored: security. That may sound obvious, but with so many packages drowning in other features, it's easy to become sidetracked. However, avoiding infection by malicious software should be your top priority.

That means that real-time malware protection is *the* critical feature of a security suite. This is a service that continuously monitors your PC for threats, primarily by scanning files and websites your computer encounters.

It's our minimum bar for inclusion in this group test. For example, the free edition of Malwarebytes is effective and justifiably popular but, unlike its paid-for version, only provides on-demand scanning.

Every product here can protect your computer against the majority of malicious software. You can take their mere presence in our shortlist – there are roughly 25 reputable products out there to choose from – as an implicit nod of approval.

ABOVE Ransomware protection can lock down your most important files

Testing procedures

Performance analysis of malware protection is in the business of assessing edge cases, unfamiliar malware and false positives. These marginal instances can have an impact on your quality of life and, potentially, the health of your PC.

Malware signatures – the hashes of known malicious files – are important to both real-time and on-demand scanning, which is why testing houses run flat file scans against large batches of recently collected malware introduced on a disk.

But polymorphic viruses and other forms of obfuscated malware have been around for years, which is where heuristic scanning comes in: this looks at characteristics and behaviours of a suspicious file or process to determine whether it's a threat.

Does it use known detection-evasion techniques such as encryption or compression ("packing")? Does it engage in potentially threatening behaviour such as attempting to delete files or terminate processes? Characteristics such as these allow antivirus software to decide whether an unknown program is likely to be a threat or not.

The fundamental question about any third-party solution is whether it can perform better than Microsoft Defender

A number of antivirus suites offload some malware detection features by automatically sending samples to their cloud for analysis – here, more processor power and AI can perform a fast heuristic assessment of potentially malicious files. While this feature is still most common in enterprise endpoint protection, you'll find it at the heart of features such as Eset's LiveGuard. These features can generally be disabled in case you're handling sensitive files that should never leave your network.

AV-TEST
The best Windows antivirus software for home users
Windows 11: October 2024
Tests for home users
Tests for business users
Internet of things (IoT)

BELOW We use data from, among others, the well-regarded AV-Test testing house

Can it beat Microsoft Defender?

The fundamental question about any third-party antivirus solution is whether it can consistently perform better than Microsoft Defender antivirus, which comes built into Windows 10 and 11. After all, Defender requires no additional software installation or payment and it won't nag you to upgrade.

Here, we review the free "for individuals" version of Microsoft Defender that ships with the operating system on the same terms as its rivals, but the fact that you don't need to install anything new or update any licences makes it a compelling choice when it comes to protecting the PCs of less tech-savvy friends and relations. But that's only assuming that its protection continues to meet the grade.

Due to the huge number of systems on which it's deployed, Microsoft has a real advantage when it comes to obtaining malware samples to analyse, which informs not only its malware signature database, but also the behavioural data it has to add to its heuristic rules of thumb for sketchy software. However, Defender isn't always best in class, particularly when it comes to the free version for home PCs. That's something that's quite obvious if you turn to the graphs on p94.

Where Microsoft does have an advantage, it seems, is performance. Every single one of its rivals slowed down the performance of systems – albeit not by a huge amount – compared to Microsoft Defender.

The effect can be noticeable on low-performance systems, and is definitely something to consider if you're planning to install software on, say, a Celeron-powered laptop.

A question of price

Free antivirus remains an important part of the anti-malware landscape. Companies benefit by processing data about malware that their free users encounter in two ways: one, it's more training data for their engines; two, they can promote their paid-for products with timely offers. They also gain a reputational boost if their free products are high quality. All of which means you shouldn't dismiss the freebies. They provide exactly the same core anti-malware engine as the full security suites.

So, why pay? For the same reason you might choose any bundled software: the idea of added value. Security suites include extra features that cost money to provide, from online password managers and cloud backup to device tracking if you lose your phone or laptop, or if it's stolen. A couple of companies even offer hands-on helplines in case you lose your wallet or have your identity stolen.

We cover more about the extra features in security suites below.

Tiers for fee-ers

Where possible, we've looked at the most feature-packed version of each security suite, and made recommendations based on its performance and how likely different users are to want its extra features. Sometimes, however, the best choice for you will be at a lower-cost tier.

To that end, before you buy, we recommend you take a close look at the different tiers on offer. Why pay an extra £5 per month for a service you don't need? You should also think carefully about how many devices you'll need to cover, as this often has an impact on price.

ABOVE/RIGHT **Third-party retailers such as Amazon are often cheaper than buying direct – as is the *PC Pro* store**

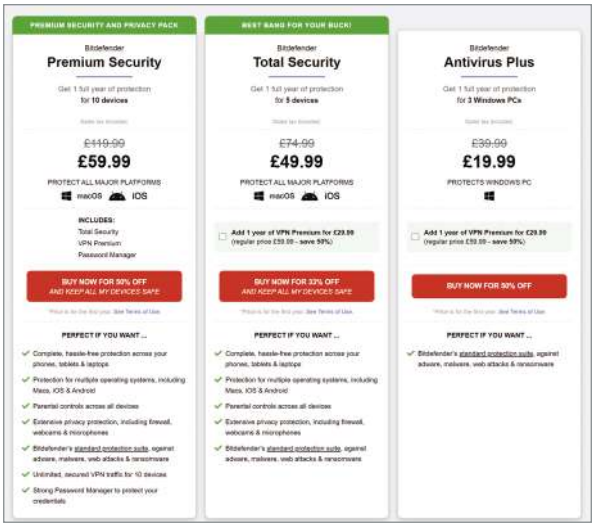
Buying direct or via third parties

In general, suppliers want you to buy direct from their sites. It's curious, then, that they often punish loyal customers with a price rise in their second year. Not that they call it that: they talk of first-year discounts, and this allows them to show big banners that scream "70% OFF!!!" But be very careful, as they will auto-renew unless you're careful, and a year later you're hit by the full and often wincingly high price.

We recommend you take a close look at the different tiers on offer. Why pay an extra £5 per month for a service you don't need?

That's why we will often direct you to third-party retailers. Amazon is generally a solid choice, but the prices fluctuate so check that you're not paying over the odds. We also recommend our own *PC Pro* store (**store.pcpro.co.uk**), as it's one of our specialist areas (and the prices are more consistent than Amazon's).

The only downside to third-party stores is that you may not be able to buy exactly the same package as provided direct. That's especially true for services such as identity tracking. Take a careful look at what's on offer to make sure it's what you want.



BELOW **Suppliers will attempt to lure you in with big first-year discounts on products**

Extra features

Our reviews are weighted heavily towards protection against malware, in real-time. However, most of the products in this group test do a lot more, helping to justify their status as fully fledged security suites.

Some of these features are very specifically to do with device security: ransomware protection that can lock down and/or back up your most important folders, web-based management consoles that allow you to remotely find or wipe lost devices, bootable rescue disks to help you recover after a malware infection, and firewall software that, in almost all cases, has a less creaky interface for creating rules than Microsoft's integrated solution.

Others are still security-oriented, but broader in the net they cast – they're usually things that you might otherwise get as a dedicated service, such as password managers, parental control software, cloud backup services and VPNs.

While it's convenient to get everything bundled together, you will rarely get the best of all worlds, and you don't necessarily want your password manager or cloud backup provider – long-term, high-security subscriptions by their nature – to be tied into a bundle with a malware protection suite that you might decide to swap for a better alternative in a year's time.

If you're a power user, you probably already have opinions and requirements about many of these things. If you use multiple operating systems, or want a VPN that you can deploy to your router, the VPNs bundled with security suites rarely provide sufficient flexibility. We will cover VPNs separately in a future Labs.

Bundled parental control suites are rarely as effective as Microsoft Family Safety or macOS Parental Controls, unless you're specifically looking for a cross-platform solution or legacy OS support. Some third-party parental control suites, including those provided with internet security suites, are also less than entirely respectful of children's rights under British law.

The final category of extras consists of tools such as local encrypted data stores, secure file shredders and Registry cleaners. Although they can be handy, there are free/open-source applications that do as well or better in almost all cases, so these can be safely ignored as filler, at best.

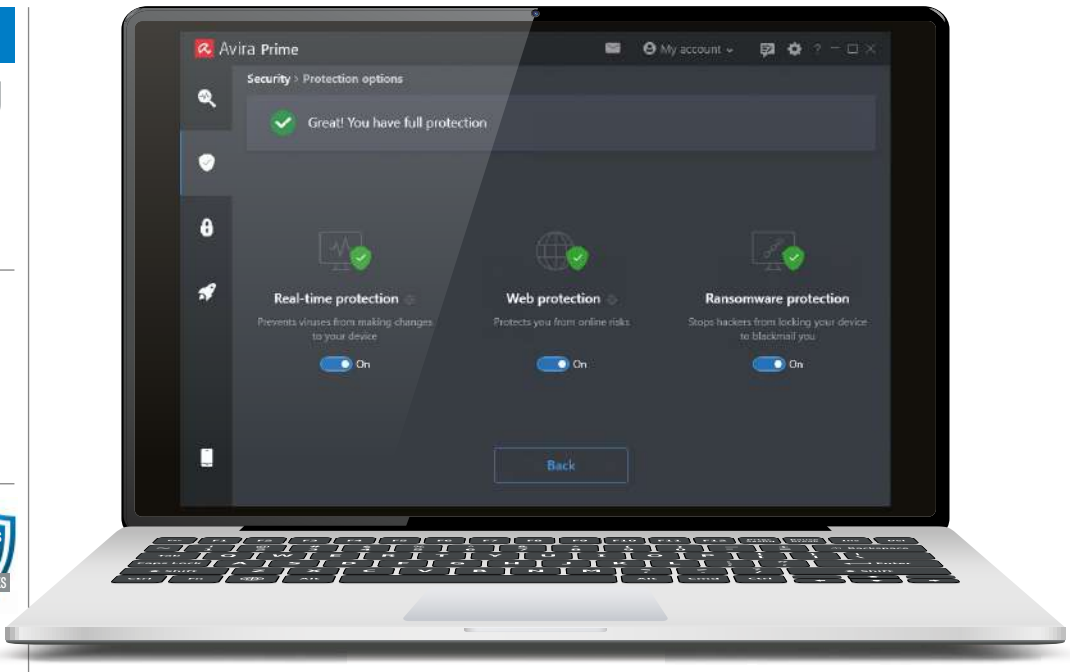
If you're mostly in the market for malware protection, with some extra options just in case you need them, then most services we've reviewed do an adequate job. You don't need to pay more to get better protection against malicious software.

AVIRA PRIME

Matching or outperforming the biggest names in AV, Avira Prime is worth spending money on

SCORE ★★★★★

1st YEAR PRICE 5 devices, £43 (£52 inc VAT) from avira.com
RENEWAL PRICE 5 devices, £76 (£91 inc VAT) from avira.com
RETAIL PRICE Not available



German brand Avira kept going as its own company until 2021, at which point it was sold to an investment company and then the internet security firm Gen Digital, which was formed when Avast and NortonLifeLock merged.

Unlike AVG, Avira continues to use its own malware detection engine and is an independent, distinct product. In fact, it did slightly better than Avast in the latest tests from both AV-Test and AV-Comparatives, though the margins are very fine. Sadly, SE Labs didn't include Avira in its latest round-up, but two data sets are sufficient to make a fair assessment of the service.

Avira's performance was the best in this test overall. It scored perfectly in AV-Test's real-world malware exposure tests and its reference set tests, with zero false positives. It didn't have a conspicuous impact on system performance, either. It was one of the top performers in AV-Comparatives' latest real-world tests, blocking 99.8% of malicious software and misidentifying only seven benign programs as threats.

It's worth noting that some of these outstanding results actually came from Avira Free. This uses exactly the same malware detection engine, but lacks the bonus features of Avira Prime. The latter, paid-for security suite, which we've reviewed here, supplements outstanding protection against malicious software with an excellent range of bonus features.

Avira Ultimate covers Windows and macOS PCs, along with Android and iOS phones, and also produces protection plugins for the most popular browsers. As a caveat, the plugins include a price comparison tool, which – like most superfluous browser plugins – we recommend avoiding, although at no point has Avira been implicated in the kind of shady practices we've seen from PayPal's Honey.

On top of the core malware protection, you get Avira's own VPN service, which can't match the region-shifting prowess of NordVPN, ExpressVPN and ProtonVPN, but does an adequate job of hopping your digital self around the globe.

Avira's firewall is friendlier to use and generally better looking that Windows' built-in option. There's also a password manager, accessed via a browser plugin or mobile app, that's barebones but does the job if you insist on using it. However, as usual, we recommend using a dedicated product, as you don't want to have to move all your passwords every time you change antivirus provider; we recommend going with Bitwarden or KeePass instead. Both are free to use and fully open source.

Back to Avira Prime. You don't get cloud backup, parental controls or fully featured device management, tracking or remote scanning of the kind Sophos offers. You can check on the status of the Avira installation of each device registered to your online account, and that's about it. There's breach monitoring for your email addresses, which will inform you if your personal data is compromised in a leak, but Avira isn't trying to compete with high-priced identity protection services. The focus here remains antivirus and device security, and it's very good at it.

The Android app includes malware detection, while its iOS app provides a blocker for phishing sites and unwanted callers. The VPN and password manager are also available on both major phone platforms.

ABOVE **Avira's performance was the best in this test overall**

PC PRO LABS WINNER

We didn't come into this test expecting Avira to win out over the big names, but it's taken the crown due to its all-round performance

Avira also makes an extremely helpful bootable system rescue disc (**tinyurl.com/366avira**), which you can download as an ISO to burn to a bootable USB stick or DVD. This boots a barebones Linux distro that can update itself and scan your system drives when they're unmounted, thus preventing any malicious software that's taken hold from defending itself.

A five-device subscription costs £50 for the first year, and automatically renews at the registered retail price – currently £75, but this may change by this time next year. A 25-device subscription is also available, and doesn't cost too much more at £112 per year . No first-year discount is available at this tier, but you can subscribe monthly for £10.72.

While we usually encourage readers to save money and avoid unexpected automatic subscription renewals by buying keys from third-party retailers, that's not currently an option for Avira Prime. However, you can buy Avira Internet Security for £30 from Amazon, with the key difference being its three-device limit and the lack of a VPN.

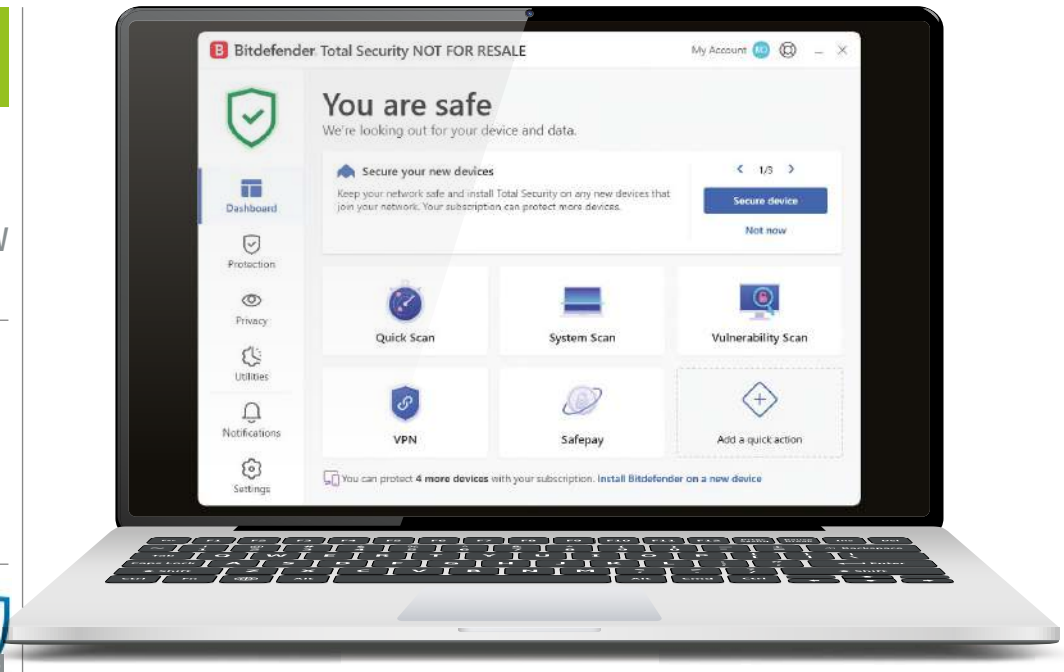
We didn't come into this group test expecting Avira to win out over such big names as McAfee, established contenders such as G Data, and its own stalemates Norton and Avast, but it's taken the crown this time due to its all-round performance. This award should also be taken as a recommendation to use and recommend the free version for any scenarios where an Avira Prime subscription isn't practical or affordable.

BITDEFENDER TOTAL SECURITY

Focused on malware protection and not bloated with pointless features, a low price makes this a winner

SCORE ★★★★★

1st YEAR PRICE 5 devices, £43 (£52 inc VAT) from bitdefender.co.uk
RENEWAL PRICE 5 devices, £63 (£75 inc VAT) from bitdefender.co.uk
RETAIL PRICE 5 devices, 1yr, £17 (£20 inc VAT) from store.pcpro.co.uk



Already a very effective security suite, Bitdefender has improved its malware detection performance from last year, and offers plenty of features without becoming too costly or bundling in irrelevant options. It's available for Windows, macOS, Android and iOS.

We don't have data from SE Labs, but Bitdefender was a top performer in AV-Test's regular assessments involving both real-world exposure to live malware and scanning of a passive set of malicious files. It detected and protected against all malware, with zero false positives of benign software. AV-Comparatives' latest real-world malware exposure test was more challenging to all the software tested, but Bitdefender blocked 99.6% of malware – only slightly behind Norton, F-Secure, McAfee and Avira – and picked up only five false positive misidentifications of benign software as a potential malware threat.

The only caveat comes in the form of AV-Test's observations about its impact on system performance, for which its score was reduced to 5.5 out of six, knocking down its overall ratings. The key offender here was its impact on software launch times, with a performance hit of up to 17% when it came to launching applications versus no malware protection, compared to an average of 11% on low-end systems. Beefier PCs were affected by a 12% launch speed impact, compared to an average 7%. Installation times were also a little sluggish compared to the best of its rivals.

Although the differences are visible in test data, it's unlikely that you'll really perceive that great an impact in day-to-day use on a powerful PC, but it could be a problem if your PC already struggles with the resource-hungriness of modern applications.

Bitdefender Total Security is a pure antivirus and computer security product and is priced accordingly. It does come with a VPN; a rebranded version of Hotspot Shield that wouldn't be our first choice if we were choosing a standalone VPN but which should be adequate for most of your region-shifting needs.

There are also parental controls, primarily managed via a web interface, which lets you set screen time limits, control application access and location-track family members. It works, but it isn't as comprehensive as the Microsoft Families feature in Windows, nor is it as compliant with international law regarding children's right to a private life.

Other features include a firewall to replace Windows' offering, and dedicated modules for browser and webcam protection, anti-spam for local installations of Outlook and Thunderbird email clients, plus ransomware protection. The latter can back up and restore important documents, but doesn't let you control which files and directories are opted into this feature.

There's also a new cryptomining protection module that protects against cryptocurrency mining software being used to exploit your PC's resources and burn electricity without your knowledge. It's switched off by default, so you'll want to manually enable it. You can have it detect and notify you of or automatically block any cryptomining activity, but you can add any cryptocurrency miners that you wish to run for your own purposes to an allow list. While any antivirus software worth its salt will protect against the malicious cryptominers, and there's no indication from test data that Bitdefender's approach makes it more effective at protecting your PC, its granular controls and ability to block mining applications that might have been deliberately and correctly installed on Windows is a solid approach, particular for family PCs with multiple users.

ABOVE Bitdefender provides effective protection through its pleasant interface

PC PRO RECOMMENDED

It detected and protected against all malware, with zero false positive detections of benign software

Bitdefender Total comes with a trial version of Bitdefender SecurePass password manager, and the more expensive Bitdefender Ultimate comes with a full version. But as usual, we advise against committing to a password manager simply because it's bundled with your antivirus. Pick a standalone one and stick with it.

Bitdefender Total Security has an RRP of £75 per year for five devices and a first-year discount that knocks £23 off that if you buy directly from Bitdefender, but the best offers are to be found in other online shops, where you'll find the same thing for £30 or less. The two leaders here are Amazon and the *PC Pro* store. You can simply buy codes from shops year after year and manually use them to extend your subscription, without signing up for automatic renewals that could sting you at an undesirable moment. If you don't need extra features, Bitdefender Antivirus Free is worth a look, too.

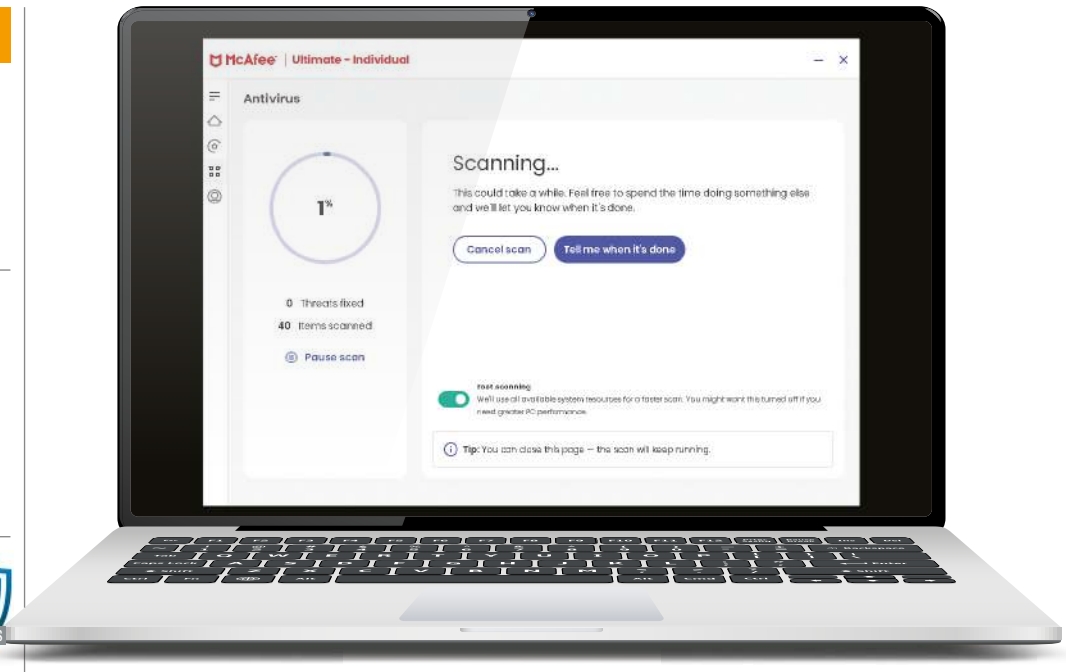
Bitdefender Total Security provides genuinely effective protection and its interface is pleasant to work with. It's reasonably priced so long as you buy from a third-party retailer.

McAFEE+ ULTIMATE

Going well beyond virus protection, this expensive suite comes with a range of identity protection services

SCORE ★★★★☆

1st YEAR PRICE Individual, unlimited devices, £142 (£170 inc VAT)
from mcafee.com
RENEWAL PRICE Individual, unlimited devices, £191 (£230 inc VAT)
from mcafee.com
RETAIL PRICE Not available


McAfee | Ultimate – Individual
Antivirus
Scanning...
This could take a while. Feel free to spend the time doing something else and we'll let you know when it's done.
1%
Cancel scan
Tell me when it's done
0 Threats fixed
40 Items scanned
Pause scan
Tip: You can close this page – the scan will keep running.

As antivirus brands merge and reform, McAfee has retained its name but hasn't been immune to changing corporate winds. In the past decade, the company has been sold by Intel, floated on the New York stock exchange and taken private again by an investment group.

Once synonymous with hard-to-uninstall OEM laptop cruft, McAfee has become both easier to live with and better at protecting against malware, but its top tiers remain expensive, and renewal costs can be extremely steep.

We're reviewing McAfee's most expensive, feature-packed McAfee+ range. This includes four products: Essential, Premium, Advanced and Ultimate. The top two tiers are significantly more expensive than McAfee's non-plus Antivirus and Total Protection offerings, which you can buy in third-party shops for very decent discounts; McAfee+ products are only available to subscribe to directly from McAfee's own website.

The unique selling point of all of them is their identity protection features. These range from simple identity monitoring in Essential, where you'll receive an email if your registered personal information appears in a corporate breach dataset, all the way up to insurance against identity theft and ransomware, hands-on identity restoration assistance, and an online account and personal data clean-up service to remove unwanted accounts you have around the internet. McAfee will also request the removal of your personal information from online data brokers.

This is so far beyond standard antivirus – where this group test is still weighted – that it's basically a different kind of service entirely. However, the overarching theme of keeping you safe in the face of online threats remains consistent.

McAfee Ultimate is wildly expensive, with an RRP of £230 inc VAT for an Individual subscription and £349 for a Family subscription. Both support unlimited devices, and the biggest difference is that the Family subscription extends identity protection to a second adult. McAfee heavily promotes the first-year reduction that takes prices down to £170 and £260 respectively, but they will auto-renew at the current RRPs.

That's significantly more expensive than McAfee Ultimate's nearest rival, Norton 360 Advanced, which has an RRP of £150 per year and deep first-year discounts, but – for all the financial and lost wallet services it includes – doesn't come loaded either with so much insurance or with the data broker removal service.

In fact, McAfee+ Ultimate is the only security service to offer quite such comprehensive service in the UK, which means that if you're looking to have your information scrubbed from the net, and particularly if you want insurance to go with it and don't want to shell out for a specialist data broker removal service such as Ingogni for around £160 a year, then this might actually look like a good deal. Especially as you also benefit from a VPN, antivirus and (for the Family sub) parental controls.

However, you'll need to enter the data you want removed and protected, and generally interact with these components if you want to take advantage of them. If you're too busy to get involved with scrubbing your data from the internet, even if you have the services, McAfee+ Ultimate will be about as effective as an unused gym membership.

ABOVE McAfee+ Ultimate provides far more than just antivirus protection

Bearing that in mind, if you're just after antivirus, check out McAfee Total Protection, which will get you antivirus plus an excellent VPN to deploy on ten devices for 15 months for just £15. The malware protection performance will be the same as that of McAfee+ Advanced, and that remains reassuringly strong.

This is so far beyond standard antivirus – where this group test is still weighted – that it's basically a different kind of service entirely

McAfee detected 100% of malware in AV-Test's real-world and reference set tests. Although it only picked up two false positives, one was a high-priority item, which saw it falsely block actions carried out by legitimate software, likely to seriously disrupt a user's workflow. This is why it was given a usability score of 5.5 out 6 by the testing house.

AV-Comparatives similarly found that McAfee was a top performer when it came to defending against malware, blocking 99.8% of threats, but also picking up ten false positives. SE Labs' tests didn't see any false positives, but McAfee's protection performance was no better than Microsoft Defender Antivirus.

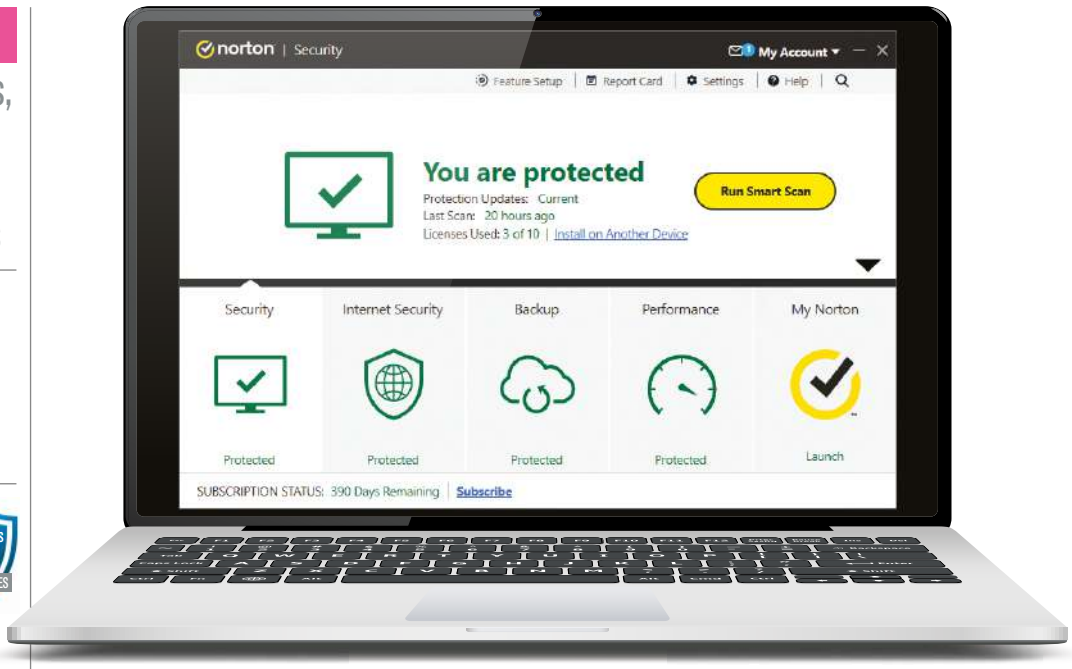
McAfee Ultimate has almost every feature you can imagine, from a VPN, password manager and parental controls to its identity protection services. It also has clients for Windows, macOS, Android and iOS devices. If it's malware detection you're after then McAfee is a solid choice, but little better than the antivirus that ships with Windows. Only spend this much if you really plan to use the identity protection services.

NORTON 360 DELUXE

A strong performer in tests, but most people will be better off buying Avira's or Norton's retail alternatives

SCORE ★★★★☆

1st YEAR PRICE 5 devices, £25 (£30 inc VAT) from uk.norton.com
RENEWAL PRICE 5 devices, £75 (£90 inc VAT) from uk.norton.com
RETAIL PRICE Not available



Norton 360 Deluxe covers up to five computers and mobile devices. We'll touch on the entire Norton 360 range, though, because the number of licences, in addition to which features you get, changes depending on which tier you buy. For example, a Plus subscription (£20) covers one device but doesn't include a VPN while Standard (odd naming) adds a VPN for £5 more. Deluxe covers five devices and adds parental controls for £30.

We've previously reviewed the top £35 Advanced tier, which doubles the number of devices to ten, includes identity restoration and credit score checking tools, and promises dark web breach monitoring. Advanced is a competitor to McAfee+ Advanced, but the latter has a far wider range of identity protection features – most notably a data broker listing removal service for your contact details. However, identity protection features remain largely beyond the scope of this specific group test's core malware protection remit. It's also worth noting that you can't associate two different Norton products with identity protection features on a single account.

Norton is one of the worst offenders when it comes to RRPs that are significantly more expensive than retail prices. In the case of Norton 360 Deluxe, the price is £20 for your first year's subscription, which then goes up to the RRP of £90 per year unless you remember to disable auto-renewal. If you want to protect ten devices, you have to pay even more for Norton 360 Advanced. Cheaper tiers are available: Antivirus Plus is a single-device product with an RRP of £35 per year, for example, but it's not really any better than Avira Free.

You can find different Norton products online for less, with variations on the same feature set. The *PC Pro* store stocks Norton 360 Premium at £10 per year for ten devices (£20 for a two-year licence), if you don't mind a little variation in the feature set and confusion over branding. Premium is the Australia and New Zealand version of more or less the same product as Deluxe. The way Norton works means you have to associate keys with your Norton account, but note that any new key you add to your account will replace the existing key for the same product, rather than being added to your remaining subscription time.

Norton's performance when it comes to malware protection is strong. It impressively detected all samples thrown at it in SE Labs' real-world malware exposure tests, with no false positives. Likewise in AV-Test's flat file scans and real-world tests, picking up only a couple of false positive misidentifications of legitimate software on the way. However, AV-Test found that it significantly slowed the installation of software and had a slight impact on file copy speeds.

In AV-Comparatives' tests it did very well at detection, picking up 99.8% of all malware in the most recent real-world exposure test. However, with 22 false positive misidentifications of benign software, it could be a nuisance.

Norton's interface is a multi-layered thing, with one front-end client giving you access to all the different Norton products you have installed, plus ads for those you lack. Then comes the Security client that lets you see overviews of and access settings for your malware protection. It's fine, but the overall experience is less slick than that of Avira or Sophos.

ABOVE It's a decent performer, but beware of Norton's steep renewal prices

While Norton's parental controls, password manager, online backup storage and VPN are fundamentally unremarkable compared to other products from more specialist service providers, they all work well. Norton Secure VPN is the best inclusion, comparing well to more specialist services such as NordVPN – unless you have advanced needs. For example, you still can't use it with any hardware other than a Windows or macOS PC or an Android or iOS smartphone.

It impressively detected all samples thrown at it in SE Labs' real-world malware exposure tests, with no false positives

We recommend you stick to Windows Family Safety for parental controls and a specialist password manager such as Bitwarden or KeePass for your passwords, however – Norton's products are adequate, but not worth tying yourself to a single subscription for everything.

Unlike Avira and Avast, Norton has problems which it comes to buying and activating licences. We ran into unexpected conflicts that made it easier to create a new account with a new email address every time we registered a key, rather than simply using our existing one. Also, it doesn't include web-based device management, unlike Sophos, and it's not as good at accurately detecting malware and letting past legitimate software as Avira and Avast.

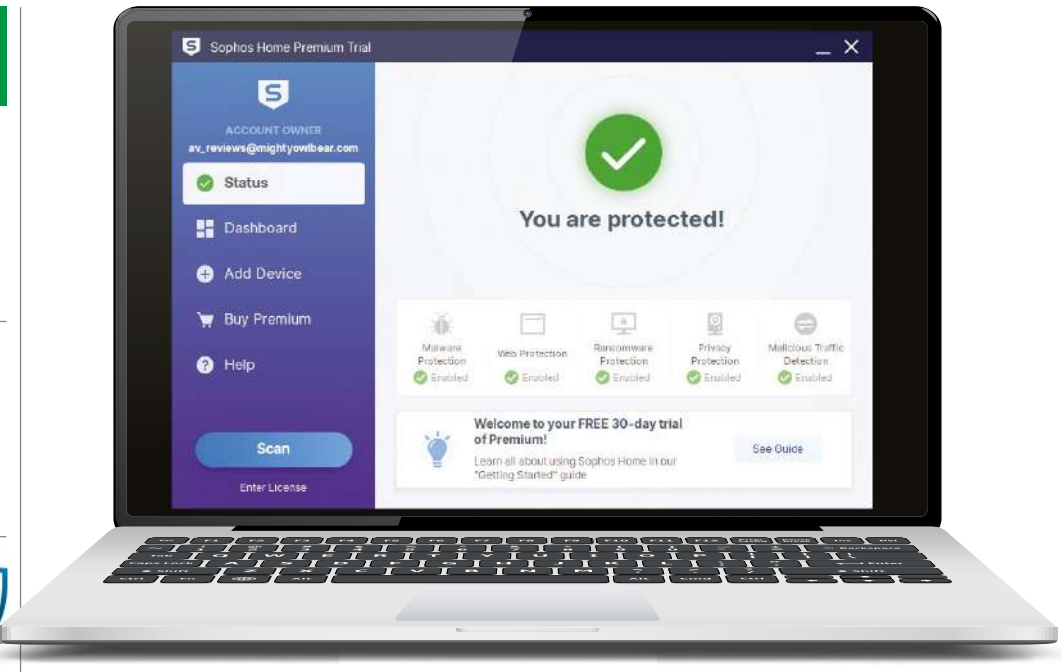
If you like the Norton approach and branding, you're far better off buying the £20 version of Norton 360 Advanced from the *PC Pro* store as this avoids the auto-renewals and covers you for ten devices and two years.

SOPHOS HOME PREMIUM

Sophos provides decent protection, but it's the fully functional remote web interface that impresses

SCORE ★★★★★

1st YEAR PRICE 10 devices, £31 (£37 inc VAT) from home.sophos.com
RENEWAL PRICE 10 devices, £42 (£50 inc VAT) from home.sophos.com
RETAIL PRICE Not available



Based in the UK, Sophos produces antivirus for home and business use, with its home offering notable for its unusually useful web-based dashboard. Sign into your account management interface on the My Sophos website and you can not only see a list of every device that the software has been deployed on, but also enable and disable protection modules on a per-device basis. You can also set up scheduled scans and run a quick scan on any computer that you've added to your fleet, assuming it's switched on at the time. This is the kind of functionality we more often see from enterprise antivirus, but with a clear and simple interface that makes it easy to manage, it's excellent.

Via the dashboard, you can apply web content filtering rules to children's PCs to prevent them from accidentally viewing inappropriate content such as violence or gambling. Or you can make sure that the ransomware protection modules – designed to prevent unauthorised encryption of files – are active on your relatives' computers, even if they're not particularly comfortable with technology themselves. This ability to discreetly ensure that your loved ones' browsing habits aren't placing them at undue risk, without invading their privacy, is one of the greatest benefits offered by the web interface.

In fact, while it looks like there's a full-blown local "Sophos Home Premium" client on your system, the buttons simply open your browser and direct you to the web interface. The exception is a scan button that does exactly what it promises. This means that, even if your PC isn't online, you can still scan it using the last update to its signature library.

SE Labs' thorough real-world live malware exposure tests shows that Sophos put in a very respectable performance, blocking 99% of malicious software before it even hit the system, and neutralising the last sample, giving it a 100% accuracy rating.

We'd have liked to include data from more sources, and – although it's not directly comparable – to some extent we can: by referring to AV-Comparatives' August–November 2024 Business Security Real-World Protection Test (**tinyurl.com/366sophos**). The core malware protection engines are the same as those you'll find in the products' home security counterparts, although there are extra features, so it's not quite a like-for-like comparison. Nonetheless, the fact that Sophos' product blocked 98.1% malware – a score slightly reduced for a couple of alerts that required user interaction to counteract the threat – is a useful data point. It's not an amazing performance, but slides in above the mean for the group (albeit just below the median).

Sophos' antivirus software isn't available to buy from third-party retailers, but the official website is very reasonably priced. You'll pay £50 per year for ten licences for PCs running Windows or macOS. A new subscriber discount takes the price down to £37. You can also attach an unlimited number of Android and iOS devices to your account without affecting the number of licences you have.

Sophos' pricing for online subscription purchases and renewals from the official website is clear and, unlike a number of rival products, doesn't throw a huge number of different packages with slightly different feature sets at you. This is a reasonably priced, all-or-nothing deal.

ABOVE **Sophos makes it easy to protect a number of PCs**

PC PRO RECOMMENDED

You can apply web content filtering rules to children's PCs to prevent them from accidentally viewing inappropriate content

The remote interface is outstanding and Sophos keeps its core security offering tight. You don't get a VPN, but that's reflected in the price, and we don't mourn the absence of a password manager or file shredder or Registry cleaner. We'd argue that these are the kinds of tools that advanced users should source from specialist companies, rather than have them as a white-label add-on or rarely updated afterthought in a security suite that would have been just as good without them.

There's no firewall, because Windows' own works perfectly well, despite an ageing interface. What we're classing as parental controls in our feature table is actually web filtering, rather than tools to spy on your family members' lives, and could just as easily be enabled for a small office as for a household.

Sophos gets bonus points for keeping both its product and its interface clean. You don't need to spend forever trying to work out which features you need – it simply does the job, and makes all the devices you install it on easy to scan and manage. Its online management interface is easily the best we've seen for users who manage others in their extended household, and that's what earns Sophos its five stars and Recommended award.

Best free antivirus (and more)

Don't want to pay for a security suite? No problem: here, we round up the best free options and extra tools to keep you safe

We've exclusively reviewed paid products in the main group test, but it's important to recognise that all the results we publish for protection would be identical if we were reviewing the free antivirus offerings. That's because the malware detection engines used in antivirus products are invariably the same across the entire range, with only extra features – such as firewalls, VPNs, password managers and system cleanup tools – being added as price tiers increase.

Here, we round up not only the best free antivirus software choices but also the best free options for on-demand scanning and single file testing.

RUNNER-UP
Microsoft Defender Antivirus

The real-time antivirus that ships with Windows PCs (*see p92*) provides genuinely effective protection against malware. Test results show that, despite Microsoft's access to a vast pool of malware samples, the free version that comes with Windows does a little worse than most of its rivals, but it protected against 98% or more threats in tests by all three labs whose data we draw on.

You can also layer it with online protection tools such as ad blockers (Ublock Origin is the way to go here), but it's active from the moment that Windows is installed. It's a particularly good choice if you're setting up a PC for a less technical person, as it fits seamlessly into the OS with no potential for confusion.

However, if you're looking at a higher-risk use case, or if you're using older hardware, you'll want third-party software.

RUNNER-UP
Bitdefender Free Antivirus

bitdefender.co.uk

Bitdefender's free antivirus has a slick interface and works just as well as its paid-for counterpart, reviewed on p85, when it comes to real-time malware protection. However, it has more of an impact on system performance than Avast or Avira, and wasn't as effective as Avira in recent detection tests.

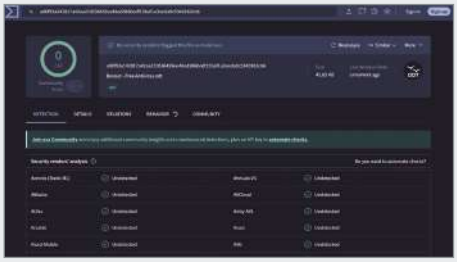
ABOVE **Avira Free is our pick of the best free antivirus tools**

RUNNERS-UP
Avast Free Antivirus, AVG Antivirus Free

avast.com • avg.com

Avast and its sibling AVG are excellent choices in terms of effective protection and performance: the data in our graphs applies as much to the free versions as to their paid-for counterparts. These slide in above Bitdefender, because although their ability to protect your PC is comparable, Avast and AVG add less load to your system.

From 2014 to 2020, Avast's now-dissolved Jumpshot advertising division siphoned data from Avast and AVG to sell to third parties, with neither permission nor sufficient anonymisation. Although it was shut down almost five years ago, it was in the news again in 2024 following an FTC settlement that saw compensation for US victims of the data misuse and a ruling that prohibits Avast from selling or sharing your browsing data for third-party advertising purposes.



BEST SINGLE-FILE TESTING
VirusTotal

virustotal.com

If you've just received a file – or if your antivirus has flagged something up as a threat that you're pretty sure shouldn't be – then VirusTotal is your friend.

Currently owned by Google, VirusTotal is a front end for over 70 malware detection engines, cloud-based scanners, website scanners and known-threat lists. Upload a file or enter a URL and it will direct all of its malware detection firepower at the target and tell you what each of them has to say about it.

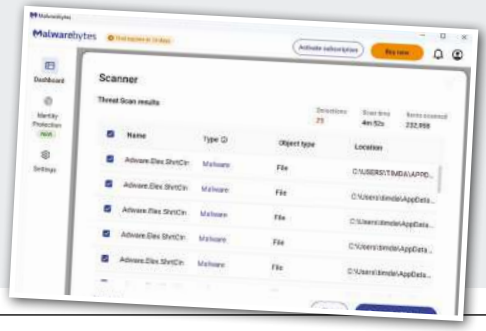
This will occasionally highlight differences. For example, some scanners draw a line between Potentially Unwanted Programs (PUPs) and malware, or classify all cracking tools as malicious whether or not they're otherwise "trojaned".

BEST ON-DEMAND SCANNER
Malwarebytes Free

malwarebytes.com

If you already have antivirus software with real-time protection installed but your system still isn't behaving quite as you'd expect, you might want a quick second opinion. That's where on-demand scanners come in: old-school antivirus programs that will only scan when you ask them to, rather than constantly checking files as they touch the file system or are run.

There are a number of free AV tools that only provide on-demand scanning, such as Eset's "Online" Scanner (**tinyurl.com/366esetscan**). However, Malwarebytes Free remains the benchmark for on-demand scanning. Note that in both cases you still need to download a file, despite the name.



WINNER
Avira Free Antivirus

avira.com

If you're looking for a free antivirus suite, Avira Free Antivirus is absolutely the way to go right now. Its detection engine was a clear winner across the board, you can run it on Windows 7, and it doesn't have too much impact on system performance.

The only downside, like every other free product here (aside from Microsoft Defender) is that it will nag you to upgrade. This starts at the beginning, when it kicks off with a scan that identified "issues" only its paid-for software can solve. But it's a fair price to pay for such effective free protection.

AVAST ULTIMATE

Avast Ultimate will keep you safe, but make sure you buy it anywhere except directly from Avast

SCORE ★★★★☆

1st YEAR PRICE 10 devices, £58 (£70 inc VAT) from avast.com
RENEWAL PRICE 10 devices, £117 (£140 inc VAT) from avast.com
RETAIL PRICE 10 devices, 2yrs, £25 (£30 inc VAT) from store.pcpro.co.uk

Since we reviewed Avast Ultimate last year, both its RRP and its reduced-cost first-year offer have increased in price. Buy direct from **avast.com** and you'll pay £110 for a one-PC subscription, up from an already ludicrous £90, while a ten-device sub has leapt from £110 to £140. Avast's heavily discounted first-year offers have also gone up, from £42 to £50 for a single PC and from £65 to £70 for ten devices. If you leave auto-renews active, your Avast sub will always renew at whatever the current RRP is, so this price inflation is important to keep an eye on.

The best tip when buying Avast is to avoid the company's own website entirely, and thus ensure that you never renew or set up an auto-renewing subscription, and instead buy a copy at retail. A two-year, ten-device subscription to Avast Ultimate is available from the *PC Pro* store for £30, and as well as setting up a new subscription, you can use retail keys such as this to add a new licence to your existing Avast account when your previous subscription runs out.

ABOVE Avast Ultimate offers solid antivirus protection

Avast was one of the most effective anti-malware suites across the board in tests carried out by AV-Test, AV-Comparatives and SE Labs. It protected against all threats in both AV-Test and SE Labs' tests, with a single false positive in everything AV-Test could throw at it. While Avast didn't do quite as well in the latest real-world exposure tests from AV-Comparatives, it was still among the top performers, blocking 99.6% of malware threats. Here, though, it proved a little twitchy, flagging 13 benign programs as threats in the lab's false positive tests.

Avast's products are always a solid choice when it comes to defending against malware, and Avast Ultimate certainly packs in plenty of features. It has silent detection options to keep it from bothering you, plus a firewall that's nicer to use than Windows' default offering. Then we come to Avast's own VPN, which isn't a rebranded version of another service. This has always been reliable, albeit not quite up there with the likes of NordVPN and ProtonVPN when it comes to region-shifting media.

Stick to retail and Avast Ultimate remains a solid buy. However, sister brand AVG uses exactly the same malware detection engine and pips it to an award this year.

ESET HOME SECURITY ULTIMATE

Excellent antivirus and VPN performance, with identity protection a bonus, but that's reflected in the price

SCORE ★★★★☆

1st YEAR PRICE 5 devices, £64 (£77 inc VAT) from eset.com
RENEWAL PRICE 5 devices, £96 (£115 inc VAT) from eset.com
RETAIL PRICE 5 devices, 1yr, £67 (£80 inc VAT) from amazon.co.uk
RETAIL PRICE Not available

Based in Slovakia, Eset is a proven player in the internet security world. Here, we review Eset Ultimate, and the first thing to note is that – unusually – the best deals are available direct from the company. Still, compared to rivals, it's expensive, so it needs to excel.

It did well in AV-Test's trials, where it detected all malware with no false positives, and AV-Comparatives, where it blocked 99.2% of threats and misidentified only three harmless applications as potential malware. SE Labs doesn't currently test Eset.

Components include a firewall, a browser protection module, a silent Gamer Mode, ransomware protection and webcam protection that grants per-application access to the device.

Eset's Identity Protection offering varies depending on where you are in the world. UK subscribers can register their personal information and be informed if it appears in stolen data being sold on the dark web. Unlike McAfee+, Eset Ultimate doesn't yet provide access to a service that will request takedowns of your personal information from data brokers. Only one person's identity is protected per Ultimate subscription.

ABOVE Eset provides a range of excellent features – at a price

Eset's bundled VPN is better than most, as it's a white-label version of Windscribe, which regularly performs well in our VPN tests. Eset also gives you a password manager, but you ideally want password management to be separate from your antivirus.

There are also parental controls, complete with device tracking.

Eset still publishes a bootable rescue disc image that you can burn to a CD or USB stick and then boot from to scan your drive for malware while it's unmounted, meaning malware can't act to prevent its own removal. Eset has improved the performance of its software for screen reader users and added high contract modes for those with low vision, a welcome move.

Eset Home Security Ultimate provides effective protection, but unless you particularly want both Eset and Windscribe VPN – both good choices – and assuming you don't need iOS support, it's worth considering the Premium tier, which is half the price.

F-SECURE TOTAL

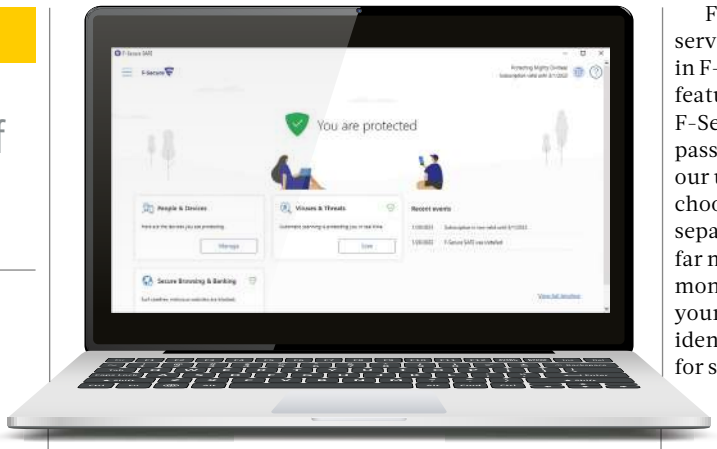
Reliable malware and identity protection, even if it's a little twitchy about false positives

SCORE ★★★★☆

1st YEAR PRICE 5 devices, £83 (£100 inc VAT) from f-secure.com
RENEWAL PRICE 5 devices, £83 (£100 inc VAT) from f-secure.com
RETAIL PRICE Not available

F-Secure Total is F-Secure Internet Security plus a bunch of additional features. The Finnish company's antivirus suites all use a pair of malware detection engines – Bitdefender's Aquaris in conjunction with its own. They're great at keeping you safe, but in AV-Comparatives' real-world live malware exposure test run by from July to October 2024, it threw up 45 false positives. That's no one-off, being in line with previous performances in this set of tests. The counterpoint to this is that it's consistently strongly protective, in this case blocking 99.8% of malware.

This indicates that F-Secure's combined engines might be on the twitchy side, blocking more sites and programs than you'd want, but it's also a reflection of AV-Comparatives' testing methodology. By comparison, F-Secure produced no false positive malware identifications in tests carried out by AV-Test, in addition to protecting against 100% of samples in both real-world exposure tests and flat file scans. SE Labs does not currently test F-Secure products.



ABOVE F-Secure uses two effective malware detection engines

F-Secure operates its own VPN service, Freedome, which is included in F-Secure Total. The other extra features you get in Total versus F-Secure Internet Security are a password manager – it's not bad, but our usual caveat applies about choosing your password manager separately from your antivirus – and, far more importantly, breach monitoring, which will inform you if your submitted email address and identity information have appeared for sale on the dark web. F-Secure will then offer support if you experience identity theft.

If you don't require these additional features, then F-Secure Internet Security is also available without the identity protection and VPN options for £60 per year for three devices. If you want either the VPN and identity protection options from F-Secure, they're reduced to £7 and £13 respectively.

F-Secure doesn't offer any first-year discounts, but its prices are already competitive by the standards of the internet security industry (once you factor in the identity protection) and there aren't any hidden renewal fees. Arguably, you're better off trying the one-month free trial and then committing for two years, which brings a £20 saving.

G DATA TOTAL SECURITY

G Data provides competent protection that won't surprise you with second-year price hikes

SCORE ★★★★☆

1st YEAR PRICE 5 devices, $68 ($82 inc VAT) from gdatasoftware.co.uk
RENEWAL PRICE 5 devices, $68 ($82 inc VAT) from gdatasoftware.co.uk
RETAIL PRICE 5 devices, 1yr, £60 (£72 inc VAT) from amazon.co.uk

G Data might not be the first name that comes to mind when you're asked to name an antivirus provider, but it consistently puts in an excellent performance in malware protection tests, year in, year out. Its interface hasn't visibly changed in years, but it does the job.

It still refers to Internet Explorer, not Edge, and long-defunct services such as Google Picasa. At least its system tuner doesn't automatically try to defrag your SSDs (a very bad idea for their longevity). Its password manager, only usable via some creaky browser plug-ins, is to be avoided. And if you want a VPN you'll have to shop for one separately, as none is included. All of which hammers home that this German company takes a different approach to rivals – and that includes invoicing you in dollars and not sneakily increasing the renewal price.

G Data's malware detection engines – it uses both its own and the Bitdefender engine – defended against 100% of malware in AV-Test's latest real-world and flat file scanning tests, picking up two false positives in the process but not placing significant load on either high or low spec PCs. It did well in AV-Comparatives' real-world exposure tests, too, blocking 99.6% of malware, but it was a little oversensitive when it came to misidentifications of benign software as a threat, clocking up 17 instances.

ABOVE G Data takes a refreshingly different approach to its rivals

G-Data provides a number of extra features that are worth your time: a firewall that improves on the Windows firewall's interface, parental controls with a focus on web content filtering, and timed access restrictions. Total Security specifically gives you even more. Sadly, most of these tools, with the exception of a local backup utility and USB device access control tool, are rather redundant, including the password manager and system performance tuner we complained about earlier.

We've been wishing for just a minor update to G Data's Windows application's interface for years now, but this is a solid example of things that don't really need fixing. Given the number of features of G Data Total that are functionally superfluous to anyone's requirements, though, you're just as well off getting G Data Internet Security as Total Security, and save yourself a tenner in the process. Or buying Avira Prime, which includes identity protection.

K7 ULTIMATE SECURITY

K7 Ultimate Security makes it appear that it's protecting you against far more than it is, and we find this deceptive

SCORE ★★☆☆☆

1st YEAR PRICE 5 devices, £31 (£37 inc VAT) from k7computing.com
RENEWAL PRICE 5 devices, £53 (£63 inc VAT) from k7computing.com
RETAIL PRICE Not available

With so many internet security companies taking a similar approach, this year we wanted to give Indian contender K7 a try, even though only AV-Test regularly puts K7's malware detection engine through its paces. While it failed to detect some malware in a flat-file scan of AV-Test's huge reference cache of infected files, it scored well in real-world exposure tests and its overall performance has been going from strength to strength. The bad news is that AV-Test's data shows that K7 notably slows down the launch of both apps and websites.

It's pretty cheap, starting at £17 inc VAT for your first year's subscription for a single device, while cover for three devices costs £25 per year and a five-device sub comes in at £37. That roughly doubles upon renewal, however, with £28 for one device, £42 for three and £63 for five. And you can't buy from third-party sites.

The main interface is pleasant (clients are available for Windows, macOS, Android and iOS) and there's a decent array of features, including a firewall, ransomware protection, basic parental controls and protection for USB devices and webcams.

ABOVE K7's trial version makes it appear that your PC is under constant threat

However, K7 Ultimate Security was actively hostile to our testing setup. Its firewall blocks Windows' remote desktop protocol by default, which to be fair can be used to exploit PCs if a bad actor uses social engineering to gain access. Less explicable was the misidentification of our virtual machine's driver files as malware. False positives happen, but a link that purported to give further information on the detected "threat" simply took us to a generic landing page on K7's site. To its credit, it was easy to find the files in quarantine and add them to the exclusion list.

K7's trial version is hyperbolic – pop-ups use bold red numbers and lines such as "Total Threats: 6115", counting both thousands of instances of network traffic automatically blocked by the firewall, as well as the false positives, so less knowledgeable users may feel pressured into extending their licence.

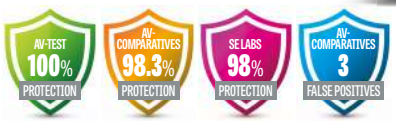
K7's malware detection engine is fine and its feature set competent, but we're unimpressed by the way it trumps up basic defence to make it appear as though your PC is under constant siege, and recommend choosing Avira instead.

MICROSOFT DEFENDER ANTIVIRUS

Windows' built-in virus protection does the job, but more effective options are available

SCORE ★★★★☆

PRICE Free



The integrated version of Microsoft Defender is the benchmark by which all other Windows antivirus is measured. When we review antivirus software, we're really trying to answer the following question: "Is it good enough to replace Microsoft Defender?"

For many users, that answer will be no. Defender protects your Windows PC from the moment you install the OS and its system impact is low, although it does slow down the installation of software compared to some commercial antivirus. It also isn't available for end-of-life Windows versions like Windows 7.

Windows Defender's performance in independent tests plays a critical role in how likely we are to recommend other antivirus software. Recently, it has wobbled in terms of malware protection from all three labs whose data we source for these reviews.

Its best result came in AV-Test's most recent outing, where it earned a 6/6 protection rating, despite missing a sample in the firm's real-world live malware exposure tests. It also made a couple of false positive identifications of benign software. It came up with a 98% accuracy rating for blocking live malware samples in SE Labs' test, with data showing it to be compromised in one instance, but no false positives. Its worst performance came from AV-Comparatives' recent real-world tests, in which it blocked 98.3% of malware samples it was exposed to, and made three false positive identifications. By no means terrible, but worse than its key free rivals.

ABOVE Microsoft Defender is a great, hassle-free solution

Defender does everything it needs to, including dedicated ransomware protection. Setting up scheduled scans via Task Manager can be a chore, but it's also irrelevant to most use cases. The firewall looks after itself and although creating rules could be smoother, it works perfectly well. Microsoft Family Safety – not part of Defender but also built into the OS – is among the best parental control systems you'll find, and also one of the most conscious of children's rights.

Unfortunately, most of Defender's additional web protections only work in Edge, but it will protect you against malicious downloads regardless of which browser you use.

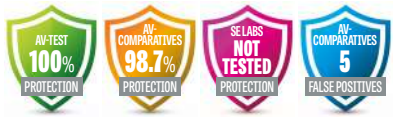
This is perfectly good antivirus that costs nothing in terms of effort or money, beyond what you've already paid for Windows. It will do a decent job of keeping you safe and not bother you, but if you want something that did better in recent tests, look at Avira.

TOTALAV ANTIVIRUS PRO

Decent value in the first year, but its renewal fees are wildly overpriced for its limited feature set

SCORE ★★★☆☆

1st YEAR PRICE 5 devices, £24 (£29 inc VAT) from totalav.com
RENEWAL PRICE 5 devices, £83 (£99 inc VAT) from totalav.com
RETAIL PRICE Not available



UK-based TotalAV's detection engine regularly appears in AV-Test and AV-Comparatives' tests, so we have plenty of data on how well it performs. In the latest tests by both labs, it barely outperforms Microsoft Defender, but still did well enough to effectively protect a PC.

AV-Test found it protected against 100% of real-time exposure and flat file reference scan malware samples, with no false positives. It struggled more with AV-Comparatives' tests, which saw it block 98.7% of malware with five false positives. That's pretty good. SE Labs doesn't test TotalAV.

The basic antivirus costs as little as £29 a year with a first-year discount (you'll see the offer when you head to the payment section), getting you five licences and some PC optimisation tools, but we can't ignore the expensive £99 renewal price. Frankly, this isn't good value in terms of malware protection performance or features compared to rivals. You can get a lot more for the same money from even big names such as Norton 360 Premium. If you want a VPN – which won't do better than dedicated software from a specialist – then you'll need to pay £129 a year for TotalAV Internet Security.

ABOVE TotalAV did okay in tests, but is no better than its rivals

If you don't buy a licence when you create an account, or if you allow your subscription to lapse, TotalAV reverts to a free version which, like the free version of Malwarebytes, only has on-demand scanning and no real-time protection. You can also choose to download this version. However, it's real-time protection that really defends you when your PC is connected to the internet.

TotalAV Adblocker and WebShield modules are free for anyone to add to their browser, and you can also get a couponing extension in a similar vein to PayPal's Honey service, although hopefully less duplicitous than the latter.

While its first year price is cheap, there's fundamentally no reason to buy TotalAV over its rivals. We were hoping for a new budget champion, but the extremely steep renewal fees of even its most basic Antivirus Pro tier makes it impossible to recommend as it offers little improvement over Microsoft Defender's integrated antivirus. If you're after premium protection, you're better off with Avira or Bitdefender.

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SCAN ME

How we test

We get hands-on with every product in the group test, ensuring that its features and interface all work as they're supposed to and highlighting any friction points. However, long-term testing with live malware samples is required to evaluate how effective any given antivirus solution is at protecting your system against malicious software.

For this, we turn to data produced by a trio of well-regarded anti-malware testing houses. Specifically, SE Labs in the UK, AV-Test in Germany and AV-Comparatives in Austria. All three publish their test data and methodologies, making them available to the public, as well as the press and industry professionals.

We use the most recent available test data in all cases. Where a specific product hasn't been tested, results for products using the same malware detection engine are used. In cases where a product hasn't been tested recently by all labs, we refer back to historic test data to provide insight into its long-term performance.

LEFT **UK-based SE Labs is one of three testing houses we use**

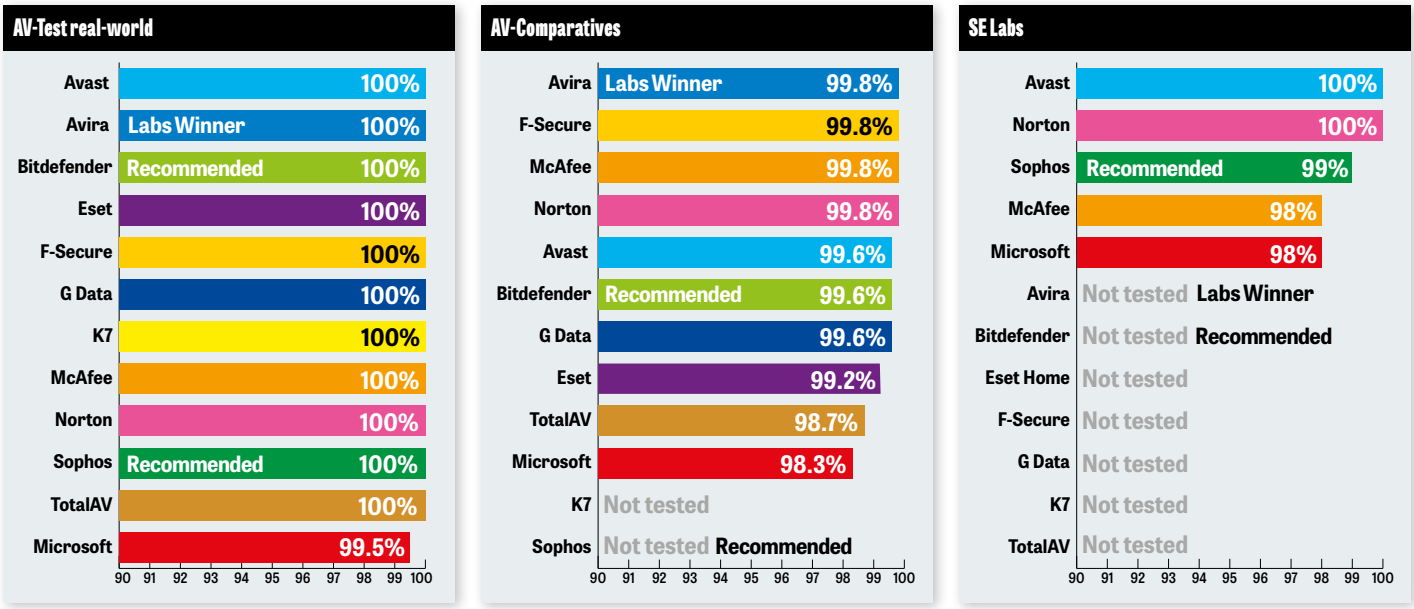
The first batch of data for this group came from the AV-Test Home Windows test October 2024, which you can check for yourself at **tinyurl.com/366avtest**. The second was from AV-Comparatives' real-world protection test, July-October 2024 (**tinyurl.com/366avcomp**).

And finally, the SE Labs Home test was from Q4 2024 (**tinyurl.com/366selabs**).

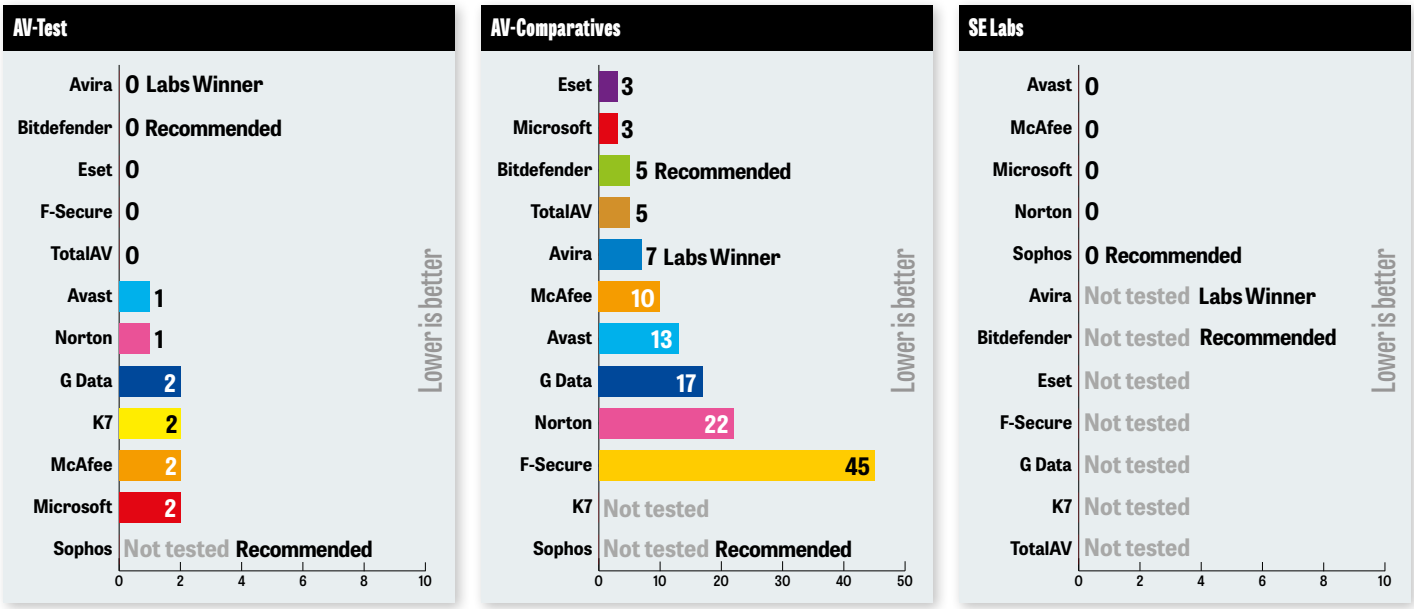
In evaluating the test data, we place the greatest weight on "real-world" testing, in which antivirus software is exposed to live malware samples in a realistic scenario, such as web exposure, rather than flat file scans of a large collection of malware samples.

We also take into account each product's impact on system performance, as measured by AV-Test, and false positive misidentifications of legitimate software and websites as malicious.

Protection



False positives



View from the Labs

Is it a security suite with a VPN or a security suite with antivirus?

Phishing is still one of the biggest threats to users' security and privacy. We all know the basic methodology: create a bait of an urgent-looking message, hook them with a link and then capture on a website where they enter their details. And that's it: you've been caught.

One effective counter-measure is to flag these "bad" websites, and such filtering is a reasonably common feature in high-end VPN services. Apart from noting that it exists, however, we reviewers have generally had few options to properly assess its effectiveness. In November 2024, that changed when NordSec commissioned AV-Test to carry out a comparison (**tinyurl.com/366phishing**) of the malicious URL blocking and anti-phishing features built into VPN clients.

Naturally, this included NordVPN, but also IPVanish, ExpressVPN, Mullvad and ProtonVPN, all of which offer a degree of screening against known-malicious URLs. No doubt NordSec dictated which products it compared its product against, and Mullvad, ProtonVPN and ExpressVPN are clear that they use blocklists and nothing else to screen out malicious sites.

By comparison, NordVPN's Threat Protection Pro module adds a malware scanner to the mix. IPVanish's approach is a little less clear, claiming to scrutinise and intercept threats, but only mentioning its use of blocklists explicitly. Notably, its results are more comparable to those of NordVPN than of the other three.

Security specialist KG Orphanides provides a quarterly testing service of VPNs at vpndatatracker.com
@kgorphanides

Although it was a commissioned test, AV-Test's methodology was clear and unbiased. While these findings would probably not have been made public if NordSec hadn't got the kind of results it was hoping for from its product, we've no doubts about their accuracy.

AV-Test exposed the four VPN services' connections to 3,209 malicious URLs, which variously pointed to executable malware files, malicious HTML and JavaScript pages, and phishing websites designed to trick users into entering vital login details or personal information. False positive tests were carried out by visiting 2,298 popular, verified uninfected HTTP and HTTPS sites. Google's Chrome browser was used in all cases.

"Dedicated VPN providers are clearly striving to become a more significant part of the internet security landscape"

Doubtless as NordVPN expected, the results were conclusively in favour of its product. Of 3,209 samples of malicious sites, NordVPN blocked 2,677 (83%), IPVanish blocked 1,507 (47%), ProtonVPN blocked 142 (4.4%), Mullvad blocked 129 (4%) and ExpressVPN blocked 89 (2.8%).

While not even NordVPN's performance of 83% of threats blocked would match that of any of the mature malware-detection engines in this month's group test, it's interesting as an extra layer of defence to keep malware from so much as touching your system in the first place.

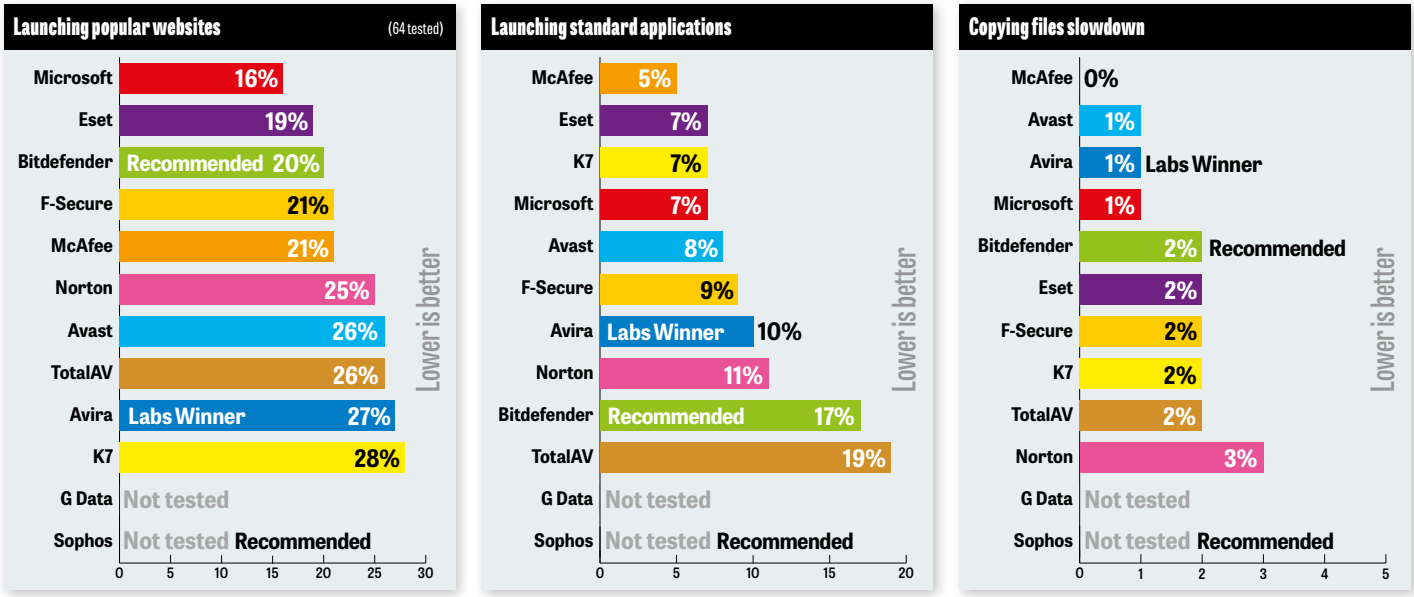
I would have liked to have seen the performance of Surfshark, NordVPN's sibling company, which states that it uses a malware scanner in addition to blocklists, but actually ships with a real-time malware scanner too. In other words, it's fully fledged antivirus software. Sadly, this hasn't yet been tested by any of the usual testing houses, but I look forward to reviewing it when there's enough data available to draw conclusions from.

This all means that dedicated VPN providers are clearly striving to become a more significant part of the internet security landscape than simply tools to watch Netflix content from other regions and a way to ensure that your traffic can't be monitored by your ISP. It's an interesting development and I'll continue to keep an eye on it in both our antivirus and dedicated VPN tests.

If it becomes generally feasible for malware to be scanned for before the URL is ever loaded on your PC – a key feature of some enterprise malware-protection services – this has the potential to alter the model used by consumer antivirus as a whole.

Performance impact

(AV-Test measured influence on computer speed)



Buyer's guide

2025 guide to network-monitoring software

Predict and fix failures before they happen, and keep your business working smoothly, with the best network-monitoring software around. Dave Mitchell puts four products to the test

In today's digital world network downtime is bad news for businesses, and a prolonged outage could be catastrophic. The immediate effect is loss of productivity and revenue, but it can have far-reaching consequences if dissatisfied customers take their business elsewhere.

An essential IT support role is monitoring network, system and application health and providing a rapid response to ensure problems or faults don't impact on productivity. Network-monitoring software is the ideal solution as it can tell you precisely what's on your network, how it's performing and alert you to issues the moment they happen.

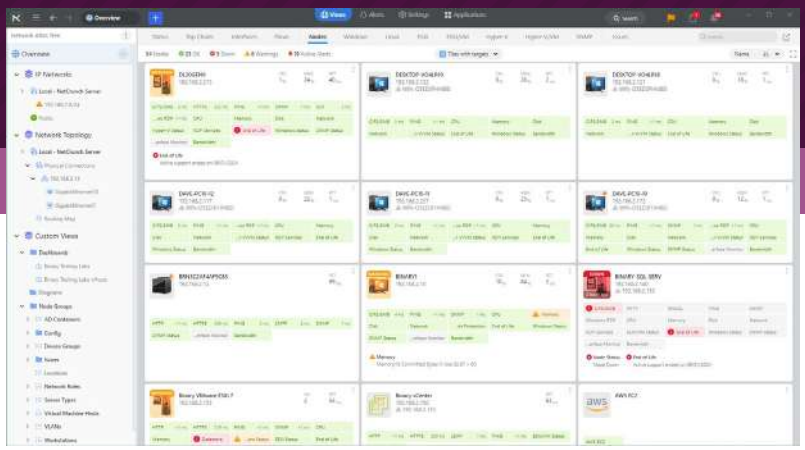
Monitoring software can help predict system failures and network issues by providing an early warning system that highlights poor service response times, an overloaded application server or one that's running out of storage capacity. This gives support staff crucial time to identify and fix a problem before it becomes a disaster.

The good news for overworked support departments is there are plenty of affordable options on the market that can help. This month, we look at four solutions from AdRem Software, Park Place, Progress Software and SolarWinds and put them through their paces in the lab to help you choose the right one.

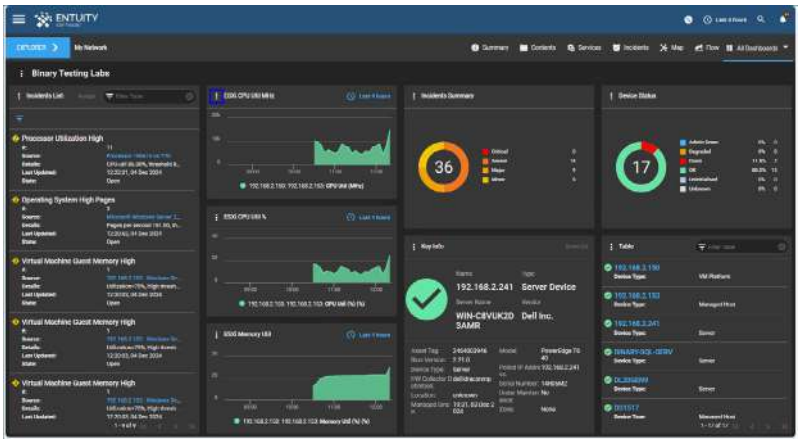
Monitoring software can provide a vast amount of data about your network, but before choosing one we recommend running an inventory of all your critical systems and deciding what you want to monitor. The reason for this is every vendor uses different licensing models that can be based on devices, sensors or the number of monitored elements, so it's vital to pick the right one to avoid overspend.

Device, or node, licences may initially seem more expensive but they allow you to monitor everything on a device regardless of the number of components it has. Elements and sensors mean the same and only allow a single resource to be monitored,

BELOW AdRem's NetCrunch lets you create custom dashboards and remotely share them with other users



LEFT **The NetCrunch Node view uses icons to clearly show the status of each device**



LEFT **Park Place's Entuity lets you create highly customised dashboards**

which could be one CPU core on a server or a single port on a network switch.

Vendors try to convince you that a per-device licence is better than a per-sensor one or vice versa, but it really comes down to what you want to monitor. Sensor licences are more cost-effective when you want to control precisely what individual resources are to be monitored, while device licences are great if you want to keep track of everything and are particularly appealing if you have a lot of high-density network switches.

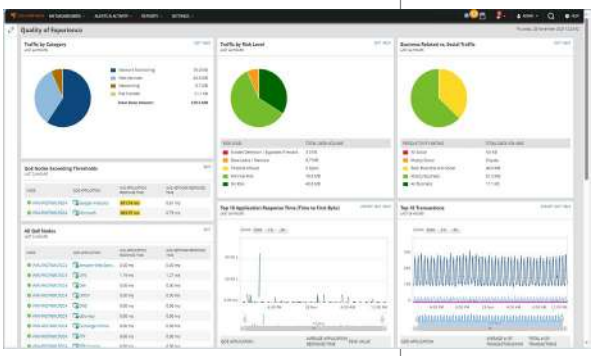
If you want full monitoring facilities for your virtualisation hosts and business apps, bear in mind some vendors only offer these components as optional features that cost extra. Check the various licence plans carefully as some include these as standard in the base product or include them in a suite licence.

Heart monitor

Network-monitoring products won't interfere with normal network operations, but you'll need to do some preparatory configuration before they are ready for action. Infrastructure devices such as switches, firewalls and routers use simple network management protocol (SNMP) to report their status. For sound security reasons this is often disabled by default so it may need to be manually enabled. If available, use SNMP3 – this is the most secure version as its traffic can be encrypted and the monitoring software must authenticate before being allowed access. Many legacy devices only support the older SNMP2, but you can tighten up security by using a unique name instead of the well-known "public" read-only community and not providing a read-write community name as this isn't necessary.

The preferred method for monitoring Windows workstations and servers is with Microsoft's Windows Management Instrumentation (WMI) service. WMI is enabled by default and provides a lot more information than SNMP, such as running services, processes and storage usage, but you'll need to provide the software with account credentials for each device to allow it to retrieve this.

It's therefore important that you lock down the software's administrative console with a strong password and two-factor authentication (2FA) if available, so access to these credentials is restricted to authorised users. You may want to delegate support functions such as viewing and reporting, so look for products that support multiple user roles with different access levels.



ABOVE **SolarWinds' Observability QoS shows how critical apps are performing**

A voyage of discovery

Automated discovery services are essential features as they scan the network and populate their databases with all device details. The best products organise and present data in meaningful ways and may surprise you by revealing more devices on your network than you previously thought.

"Automated discovery services are essential as they scan the network and populate their databases with all device details"

When a device or resource goes down you need to know about it immediately, so look for products that have consoles with top-level dashboards that highlight these areas. Built-in Top 10 dashboards can be invaluable as they show details such as systems with the highest CPU, memory, disk and network interface utilisation – indicators that problems could be round the corner. Another valuable feature is the ability to customise dashboards so you can choose the data you want presented and in what order.

Alerting is just as important as you may not always be watching the monitoring console. Facilities to issue alarms when a device goes down can range from sending an email, posting a Microsoft Teams message, issuing an SMS or running a program.

Look out for network operations centre (NOC) views; you can use these to present your support department with a heads-up display showing network pain points that require their immediate attention. Some products only support a single NOC view, but the best ones allow you to create slide decks of your favourite views and cycle through them at predefined intervals.

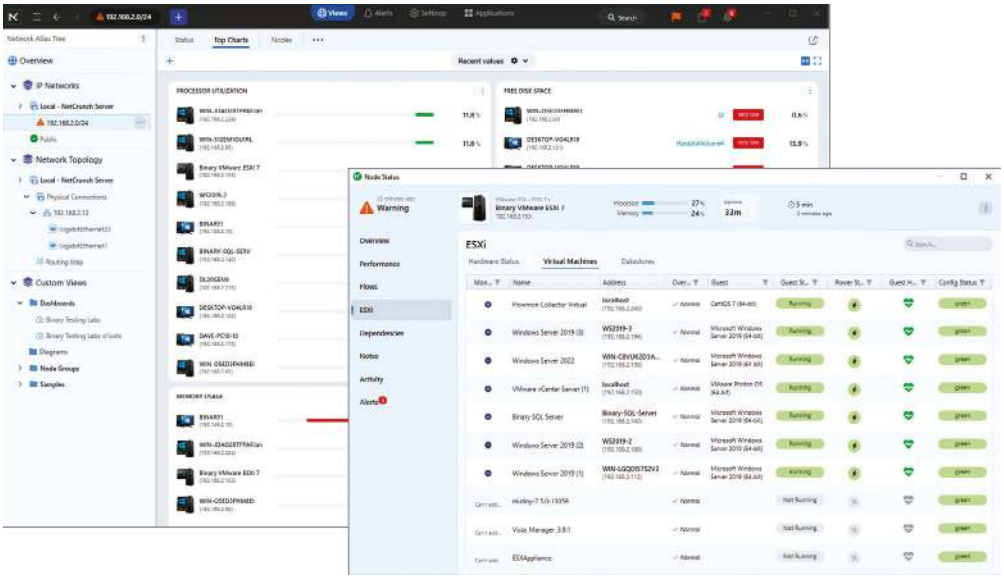
With so many different features, a multitude of licensing schemes and price ranges to match, it's important to choose the network-monitoring package that best suits your environment. With this in mind, we've specifically selected the four products for this guide as they're all available as time-limited evaluations with all features enabled either as free downloads or on request.

AdRem NetCrunch Professional 15

Fast deployment, smart dashboard views and plenty of features make NetCrunch a solid choice for SMBs

SCORE ★★★★☆

PRICE From £2,350 exc VAT per year from adremsoft.com



SMBs are spoilt for choice with network-monitoring products, but AdRem's NetCrunch stands out from the crowd for a number of reasons. One feature we've always liked is its lightning-quick deployment, and version 15 is no exception: we loaded its Server and Console components on a Windows Server 2022 host, followed the discovery wizard and were presented with a complete readout of our lab network in only 20 minutes.

The NetCrunch console has been redesigned to make it even easier to use and opens with an informative Atlas overview page that uses colour-coded icons of all monitored devices so you can see at a glance which ones have issues or are offline. Custom views take this further, automatically presenting details based on the content selected in the left pane, while full search facilities apply your criteria to nodes, the Atlas view and program settings, making it easy to find a device of interest.

The new Dashboards feature is limited only by your imagination. Its smart editing tool allows you to create highly detailed custom views using any monitored system, individual sensor or chart and drag and drop each widget into the desired location. We had no problems creating a custom dashboard for monitoring our VMware ESXi and Hyper-V hosts and used the new data-sharing and NetCrunch Connection Cloud features to send a password-protected web link to external users so they could view it remotely.

Different viewpoints are easily accessed from the upper ribbon menu, with the Top Charts tab presenting a graphical view of nodes neatly sorted into groups so you can see which have the most alerts, those with the highest CPU usage, the slowest responders, the top talkers and more. Click on the three dots at the top right of any chart and you can pull up a performance trend graph for any time period you want.

The Nodes page shows all monitored devices, and applying one-click filters shows systems that are down, those with critical alerts or in a warning state. The Active Alerts page provides real-time views of the latest network issues, which can be filtered by severity, and moving to its Analytics page presents graphs of all alerts over the last day, week or month.

ABOVE NetCrunch presents a range of highly informative dashboards

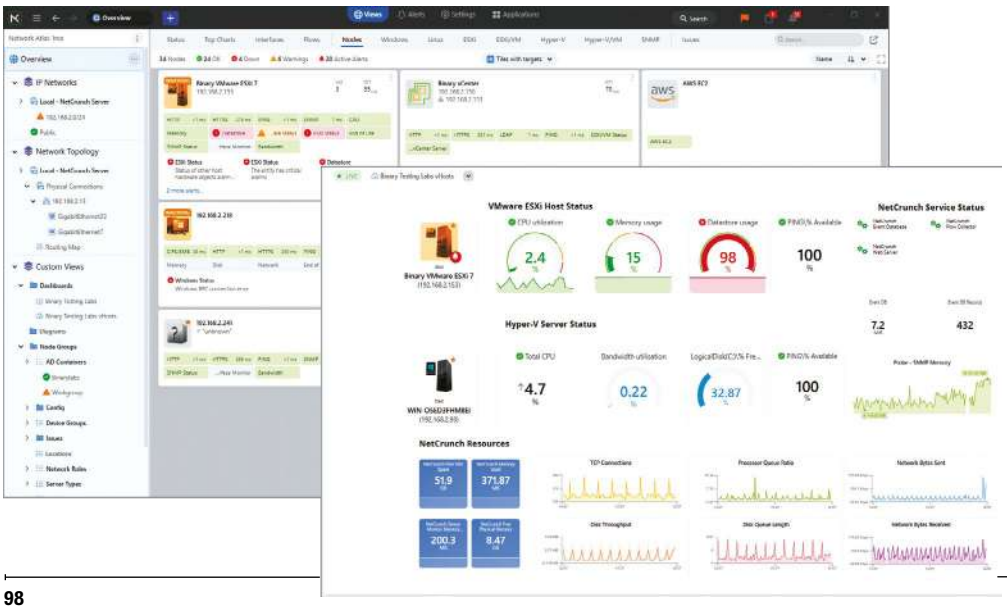
The NetCrunch Monitoring Packs are a great feature as they group together performance data and alerts for specific devices or services and are automatically assigned during the discovery process. The Professional version on test offers hundreds of different packs, with the Enterprise version including ones for monitoring Dell and HPE server management controllers and cloud services such as Amazon Web Services, Microsoft Azure, 365 and OneDrive, Google and Zoom.

"It's incredibly easy to deploy, and the highly informative central console ensures support staff are always one step ahead"

There are far too many to list here, but we did like the antivirus check packs with ones available for virtually every product you can name. We run Sophos Endpoint Protection on some of our labs systems and could add a specific sensor to them that verified that the Sophos endpoint agent was running.

AdRem offers a range of licensing plans, with the Devices version aimed at those that want to monitor systems, services, virtualisation hosts and cloud services. Prices start at £2,350 per year for 250 nodes and interfaces, which AdRem claims is the equivalent of monitoring 2,500 device aspects, while a perpetual licence begins at £7,050.

AdRem's NetCrunch 15 takes all the hard work out of network monitoring, and its flexible licensing schemes make it a good choice for businesses of all sizes. It's incredibly easy to deploy, and the highly informative central console ensures support staff are always one step ahead of network issues.



BELOW Colour-coded icons clearly show device status

REQUIREMENTS

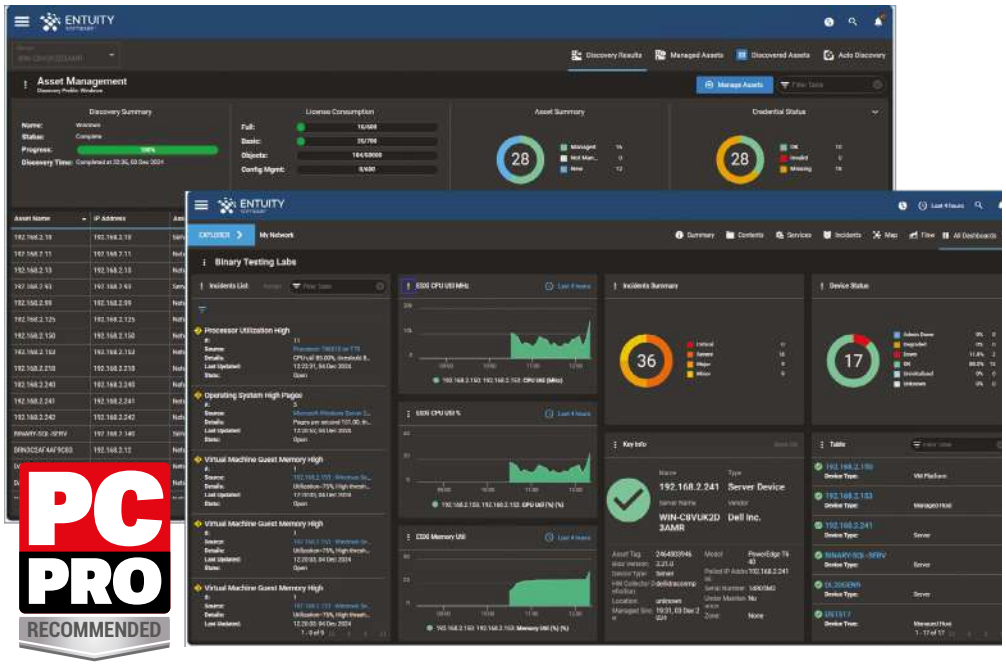
Windows Server 2016 upwards

Park Place Technologies Entuity 22

A wealth of monitoring features presented in a well-designed web console with simple licensing plans

SCORE ★★★★☆

PRICE From $150 per node/year
from parkplacetechnologies.com



Entuity from Park Place Technologies will appeal to SMBs worried about hidden costs as its licensing is based only on nodes. The yearly starting price of $150 per node may seem high but this includes many features other vendors charge extra for such as IP address management, Flow analysis, device configuration management and cloud monitoring.

Entuity can be run on Linux or Windows Server 2019/2022 platforms and minimum system requirements are modest, with smaller environments requiring only a 6-core Xeon E3 CPU, 6GB of memory and 60GB of storage space. Entuity can be virtualised so we opted to install it on a Windows Server 2022 VM on the lab's VMware ESXi host, which took 30 minutes.

Some vendors expect you to supply your own production database, but Entuity's default MariaDB is fine for all environments. Network discovery is fast: after we created a list of device credentials, our first job took only five minutes to scan the entire lab subnet.

The Entuity web console is well designed and provides customisable dashboard views, with nearly 100 predefined ones that you can duplicate and use as a basis for your own. These are built using "dashlets", which define specific device metrics and can be moved around to the preferred position, previewed and saved.

Discovered devices are viewed from the console's asset management page. Selecting one transports you to a summary dashboard that reveals all the information Entuity has gathered about it. For our Windows servers, we could see the OS version along with current incidents, and swapping to the hardware view presented resource utilisation graphs plus details of network ports and logical volumes.

Virtualisation host monitoring is included as standard, with our VMware vCenter dashboard providing charts for performance, vSwitches, datastores, hypervisors and clusters. The default dashboard for our ESXi 7 hypervisor also provided data about its hardware and the status of all VMs.

Entuity 22 delivers plenty of new features, with vulnerability scans using CVE lists published by NIST warning if any devices are running risky firmware versions. Expiry dates for web app SSL certificates are checked every day, while more dashlets are provided for AWS and Azure cloud service monitoring

We run a lot of Dell and HPE servers in the lab and were pleased to see that iLO and iDRAC monitoring is another standard feature with the default dashboards showing every server hardware component and their status.

ABOVE Entuity offers fast network discovery and easily customised dashboard views

"Entuity delivers an impressive toolbox of monitoring services all easily managed from a central web console"

The network switch dashboard is another winner as its real-time summaries show hardware utilisation and latency, while the ports tab presents charts for port status, all unused ports and how long they've been inactive, with a table below showing the devices connected to each one.

Entuity's event administration provides a design tool for creating notification projects that link traps, events and incidents with rules, variables and conditions, which are then assigned to actions. These include email, ServiceNow, Slack, Splunk and Microsoft Teams channels.

SurePath uses agents to monitor external web locations and provide hop-by-hop maps with latency and packet loss details. It's optional but worth considering as it's only licensed by the number of paths required.

Well suited to larger networks, Entuity delivers an impressive toolbox of monitoring services all easily managed from a central web console that offers an incredible range of informative dashboards. Its simple node-based licensing makes it easy to manage ongoing costs, and you can try out Entuity as Park Place offers a 30-day trial on request which includes engineer assistance.

BELOW Virtualisation host and network switch monitoring are included as standard

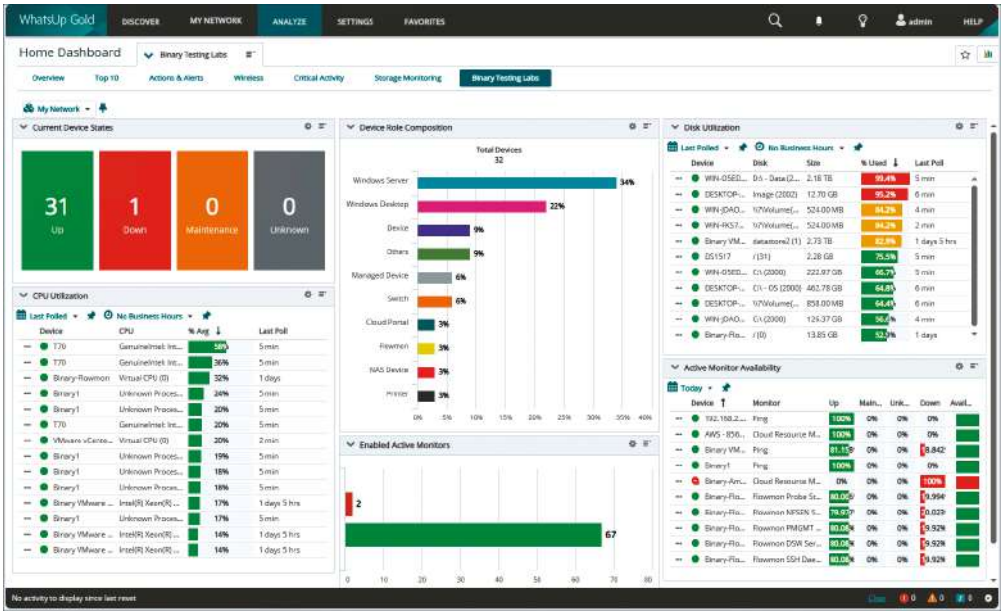
REQUIREMENTS
Windows Server 2019 upwards, Linux

Progress WhatsUp Gold 2024

A great-value choice, with heaps of network-monitoring tools and a highly informative web console

SCORE ★★★★★

PRICE Enterprise, 50 devices, £1,177 exc VAT per year from whatsupgold.com



Few can match WhatsUp Gold (WUG) for longevity: it has been a major player in network-monitoring for nearly 30 years, and Progress Software continues to enhance it with new features.

WUG 2024 has a sharp focus on customisation and improved reporting. Performance monitors can now be modified with filters to exclude irrelevant data such as the Windows system reserved partitions, and Alert Center email notifications can be improved with options to fully customise the message body.

Devices that breach their assigned thresholds trigger an alert and WUG can now inform you when a device automatically recovers and goes back within its thresholds. Changes to active monitor policies can be applied in bulk to multiple devices, and the monitor library now includes hyperlinks so you can see which devices they are applied to.

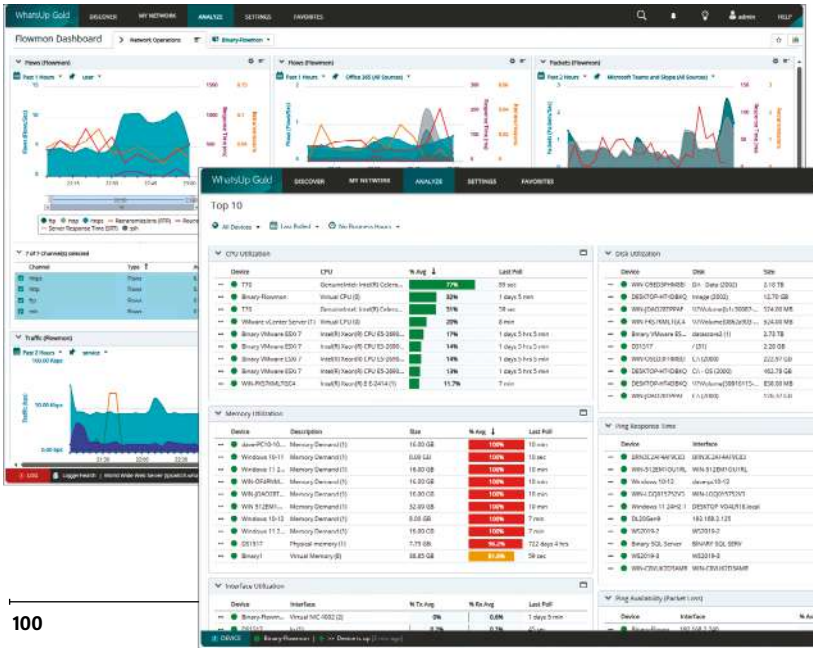
There are lots of subscription plans, as well as a free version that can monitor up to ten devices regardless of the number of network ports, CPU cores or storage devices. The Business edition starts at around £706 per year for 50 devices and enables all key features including network discovery, topology mapping, alerting and reporting, plus cloud, wireless network and storage monitoring.

The Enterprise edition on review costs £1,117 for 50 devices and adds log management plus virtualisation host and application monitoring. Enterprise Plus ups the price to £1,727 and includes switch, router and firewall configuration management, along with the network traffic analysis component.

Installation on a Windows Server 2022 host took 30 minutes and, after adding all device credentials, our first wizard-assisted network scan took only ten minutes. WUG spotted all our Windows systems, switches, virtualisation hosts, firewalls, NAS appliances and printers

We run a virtualised Progress FlowMon appliance in the lab and WUG picked this up as well. After adding Rest API credentials, we could feed its traffic data directly into the WUG analysis dashboards.

ABOVE Custom dashboards can show your choice of devices and status views



BELOW FlowMon data can be fed into the console while the Top 10 view shows which devices need attention

PC PRO A-LIST

"WhatsUp Gold 2024 is a great choice for SMBs as it presents a clear picture of your network and is available in a wide range of affordable licensing plans"

The smart web console makes device monitoring a breeze, and WUG automatically applies a base set of active and passive monitors and thresholds to each one. The console is easy to navigate, with all features gathered under five main menus in its upper ribbon bar, and frequently used views can easily be added to the Favorites tab by clicking on the star icon at the top right of the console.

Devices are assigned colour-coded icons so you can see immediately if they are up or down, and linking them to state change policies allows actions such as running scripts, restarting services or sending alerts to be applied. Analysis dashboards can be customised to show whatever you want, and support departments will like the network operations centre feature as they can create slide decks of multiple dashboard views with a display duration.

We run Hyper-V and VMware systems in the lab and found WUG's virtualisation monitoring very useful as we could see host resource usage and all running VMs along with their vCPU, memory and network use. The application monitor makes life easy by running discoveries on devices for apps selected from the WUG library and adds them to the analysis dashboard for at-a-glance status views.

WhatsUp Gold 2024 is a great choice for SMBs as it presents a clear picture of your network and is available in a wide range of affordable licensing plans. It's a cinch to deploy, doesn't require a lot of host resources and the new features make it even easier to customise it for your environment.

REQUIREMENTS

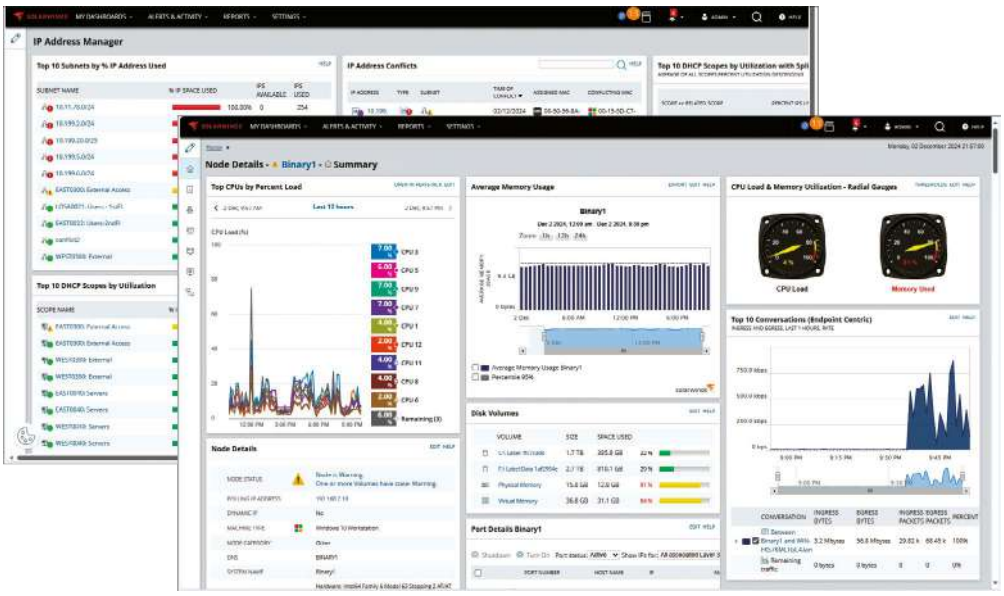
Windows Server 2016 upwards

SolarWinds Observability Self-Hosted Essentials

A big bundle of monitoring tools wrapped up in a smart web console, with greatly simplified licensing plans

SCORE ★★★★☆

PRICE From £4.25 exc VAT per node from solarwinds.com



SolarWinds offers lots of network-monitoring and systems management solutions, but the different licensing models can make buying separates a complicated process. The Observability suite comes to the rescue as it amalgamates all key products into one solution and uses simple node-based licensing.

Deployment options are extensive, with the Observability SaaS version hosted in the cloud for you while the Observability Self-Hosted (OSH) on review can be run on-premises and in your own cloud. OSH Essentials starts at £4.25 per node and includes the Network Performance Monitor (NPM), Log Analyzer, Server & Application Monitor (SAM), IP Address Manager, VoIP & Network Quality Manager (VNQM) and User Device Tracker (UDT).

OSH Advanced ups the price to £7.43 per node and adds the Network Configuration Manager, NetFlow Traffic Monitor, Virtualization Manager (VMAN) and Server Configuration Manager. There are also two OSH Enterprise options for larger businesses that start at a minimum of 500 nodes.

OSH Essentials used one routine to load all suite components in around 45 minutes. They're easy to manage, too, as everything is neatly integrated into the SolarWinds Orion web console.

OSH starts with NPM's network discovery, which took ten minutes to deliver a detailed list of all our lab systems. It can present a huge amount of information, but this can be easily refined using dashboards where you choose the number of columns, add resource views, move them around to suit and preview them.

Modern dashboards offer more detailed widget-based displays using key performance indicators from any OSH module. The SolarWinds query language Studio app is provided for building them and first-time users will find lots of help in the SolarWinds THWACK online community.

Standard features include the NPM PerfStack Analysis tool, which identifies the root cause of network problems by comparing data collected from multiple devices in one dashboard. The Quality of Experience service uses sensors linked to switch mirror ports to identify, categorise and analyse traffic for over 1,500 applications, while NetPath monitors external web locations and warns of cloud service performance issues.

ABOVE The suite includes SolarWinds' flagship Network Performance Monitor

PC PRO RECOMMENDED

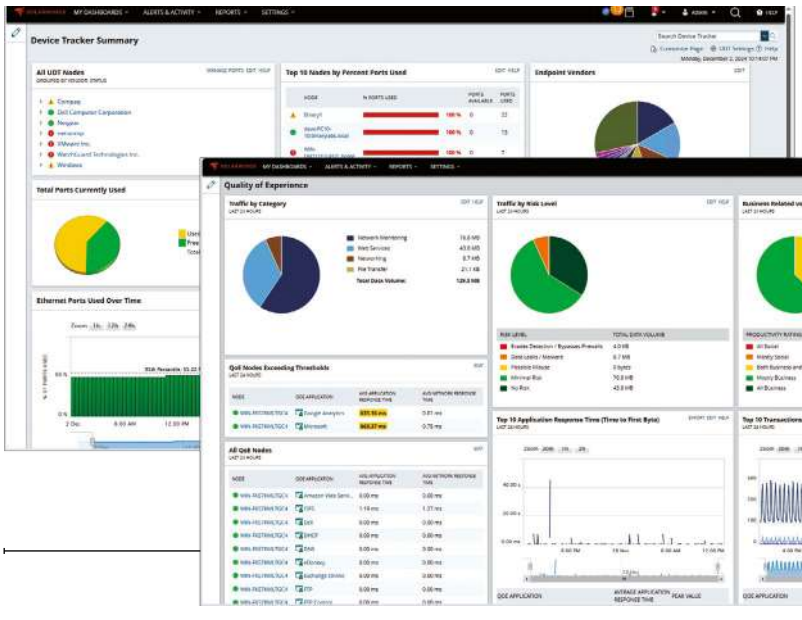
"The Server & Application Monitor uses templates for monitoring Windows and Linux servers and can keep a close eye on business apps"

OSH Essentials provides basic availability monitoring of VMware, Hyper-V and Nutanix on-premises and cloud hosts. If you want more you'll need to upgrade to the Advanced version or buy the VMAN component separately. This monitors virtualisation hosts, reports on CPU, memory and datastore usage, provides views of VM resource use and health, and creates capacity planning reports.

The VNQM module supports Cisco, Juniper and Avaya devices and provides detailed views of call quality, latency and failed calls, and also offers a search facility for locating specific VoIP calls. As long as you don't put a VM agent on them or specify them as nodes, AWS and Azure cloud service monitoring is free, while UDT polls switches, routers and Active Directory domain controllers to provide real-time data on network devices, their connections and user login activity.

SAM uses templates for monitoring Windows and Linux servers and can keep a close eye on business apps such as Active Directory, Exchange, IIS and SQL Server. For Microsoft 365 environment monitoring, SolarWinds has replaced its outdated and clunky PowerShell queries with API poller templates, which are easier to use and more informative.

SolarWinds Observability Self-Hosted Essentials offers SMBs a big network-monitoring toolbox with a simple and affordable licensing system. There's a lot to play with so it will take a while to get it configured to your requirements, but the suite is surprisingly simple to install and easily managed from a single web console.



BELOW The various consoles can be easily customised to show what you want to see

REQUIREMENTS

Windows Server 2016 upwards

EnGenius ECW526

A good-value cloud-managed business Wi-Fi 7 AP with plenty of features and an impressive turn of pace

SCORE ★★★★★

PRICE £225 exc VAT
from solwise.co.uk

When we reviewed EnGenius' mighty BE19000-rated ECW536 Wi-Fi 7 access point (*see issue 365, p98*), we were bowled over by its great combination of features and performance. Its £406 tag may be a bit steep for smaller businesses though, and for them there's the ECW526, which offers a scaled-down set of Wi-Fi 7 features at a more appealing price.

Behind the scenes is the same powerful Qualcomm Networking Pro 1220 hardware platform featuring a 2.2GHz quad-core ARM Cortex-A73 CPU. The ECW526 presents six spatial streams – half as many as the ECW536 – but this still delivers an impressive BE9500 rating comprising 5,800Mbits/sec on the 6GHz radio, 2,900Mbits/sec for 5GHz and 720Mbits/sec for 2.4GHz.

The AP ensures there are no bottlenecks as it boasts a 10GbE port; most similarly priced Wi-Fi 7 APs only have a 2.5GbE port. It requires a PoE+ source and, although there's a power jack alongside, an adapter isn't included.

The Qualcomm and 10GbE combo delivers in the speed stakes. For testing, we connected the ECW526 to the lab's Zyxel XS1930-12HP 10GbE multi-gig PoE++ switch and used a Lenovo Windows 11 24H2 desktop client equipped with a TP-Link Archer TBE550S Wi-Fi 7 PCI-E adapter. Starting with Microsoft's NTTTCP utility, we recorded impressive raw upstream and downstream rates of 309MB/sec and 264MB/sec between the client and a Windows server on our 10GbE LAN.

Real-world speeds are good, with close-range large file copies between the client and server averaging 245MB/sec. Moving the AP ten metres away into an adjoining room saw top average copy speeds of 218MB/sec.

The ECW526 must be managed using EnGenius' cloud portal, as its local web browser interface only displays an overview of LAN, internet and cloud connection status. To add the AP to our cloud account we used the Cloud To-Go iOS app on an iPad to scan its QR code.

The AP was automatically added to our organisation, where it took all our predefined wireless settings and started broadcasting them. The cloud portal opens with a freshly designed dashboard showing connection details of APs and switches, with doughnut graphs revealing the number of connected wireless clients and power status for PoE switches.

These changes are only minor, but if you prefer the older dashboard you can swap back to it with one click. The rest of the portal hasn't changed, with each site supporting up to eight SSIDs. For each one, you can decide which radios are active, enable L2 isolation, band steering and fast roaming. You can also apply download and upload rate limits for the entire SSID or per client.

WPA3 encryption is mandatory for Wi-Fi 7 clients, but you can present SSIDs that enable all radios and use mixed WPA2/WPA3 security. Sensibly, you aren't allowed to create unsecured SSIDs, but there's an option for using OWE (opportunistic wireless encryption) to present safe open public networks, and the ECW526 supports the Wi-Fi 7 MLO (multi-link operations) feature.

You can present guest wireless users with a captive portal that supports authentication methods such as click-through, EnGenius cloud-managed users, Radius, voucher and Facebook account logins. A splash page is displayed to guest users, and it can be easily customised from the portal's integral HTML editing toolbox.

EnGenius offers a Pro version of the cloud portal that enables enhanced features such as a 30-day log retention period, network topology views and seven-day timeline charts of the APs a client connected to, authentication methods used and details of errors such as incorrect passwords. You get a 90-day Pro subscription trial included in the price, with a one-year subscription costing £46 per device or £110 for three years.

The ECW526 will appeal to SMBs looking to make the move to Wi-Fi 7 as it combines a great feature set at a tempting price. Cloud management services are extensive and its potent Qualcomm CPU and 10GbE port deliver superb wireless performance.

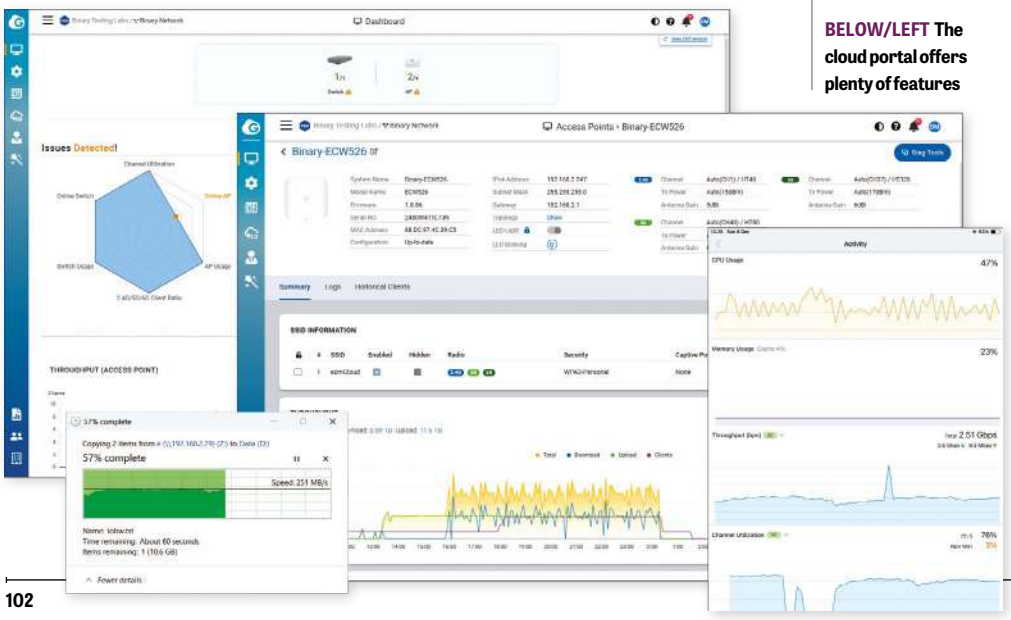
DAVE MITCHELL

ABOVE **The ECW526 delivers great Wi-Fi 7 performance for the price**

LEFT **Unusually for the price, the ECW526 has a 10GbE port**

PC PRO RECOMMENDED

"We recorded impressive upstream and downstream rates of 309MB/sec and 264MB/sec between the client and a server"



BELOW/LEFT **The cloud portal offers plenty of features**

SPECIFICATIONS

BE9500 tri-band 2.4GHz/5GHz/6GHz 802.11be • 2.2GHz quad-core Arm Cortex-A73 CPU • 6 x internal aerials • 10GbE LAN/802.3at PoE+ • wall/ceiling mount kit • 12V DC input (adapter not included) • 190 x 190 x 39mm (WDH) • 720g • 90-day Cloud Pro trial licence • 2yr hardware warranty

Qnap TS-433eU

Minimal upgrade potential, but this affordable NAS delivers plenty of features in a remarkably small chassis

SCORE ★★★★☆

PRICE Diskless, £528 exc VAT
from ukstore.qnap.com

Qnap's TS-433eU will appeal to small offices with limited space as it's probably the smallest rack-mount NAS appliance on the market. Presented in a chassis that's a mere 292mm deep, it can be easily fitted in a small wall box, a standard two-post rack cabinet or even placed unobtrusively on a desk.

The appliance offers four hot-swap LFF/SFF drive bays at the front and is powered by a 2GHz quad-core Arm Cortex-A55 CPU. It comes with 4GB of DDR4 RAM, but this is soldered on the motherboard and cannot be upgraded.

Networking comes courtesy of dual 2.5GbE multi-gigabit ports, and two USB-A 3.2 Gen 1 ports can be used to expand storage outside the box with Qnap's equally short four-bay TR-004U disk shelves. No expansion slots are provided so 10GbE is off the menu and, unlike some of Qnap's other short-depth appliances, the TS-433eU doesn't have internal M.2 SSD slots.

The appliance is clothed in a solid steel chassis and uses equally sturdy metal carriers. For testing, we fitted three 12TB Seagate IronWolf NAS drives; Qnap doesn't enforce the same drive compatibility restrictions as Synology so you can use pretty much any storage device you want. We also noted that the appliance's three 40mm cooling fans were extremely quiet.

The modest memory capacity limits the TS-433eU to running Qnap's QTS operating system as its QuTS hero OS requires a minimum of 16GB to get the best from it. This is no bad thing for small businesses as QTS is more nimble, requires far less memory and offers an equally impressive range of features.

Installation was swift, with the QFinder Pro Windows app quickly discovering the appliance and directing us to its web interface, where a quick start wizard installed the latest QTS version. On completion, we used the Storage & Snapshots app to create a large 22TB RAID5 array.

QTS offers plenty of business apps, although some aren't available for ARM-based CPUs such as the Virtualization Station, Hyper Data Protector and Browser Station. You won't be able to use Qnap's new NetBak PC Agent, either, as although it offers block-based backups for Windows workstations and servers, it requires the Hyper Data Protector app to be installed.

Backup features are still in abundance, however, with QTS supporting on-demand and scheduled snapshots for NAS shares and iSCSI LUNs, with the Snapshot Replica service offering scheduled block-level replications to a local storage pool or remote Qnap NAS. The Hybrid Backup Sync 3 app protects appliance data and helps create a 3-2-1 backup strategy in as few as four clicks, and you can still use Qnap's older free NetBak Replicator Windows agent, which manages simple file-based workstation and server backups to the appliance.

ABOVE **The miniature TS-433eU offers four hot-swap LFF/SFF drive bays**

"The TS-433eU offers space-poor SMBs an entry-level network storage solution at a sensible price"

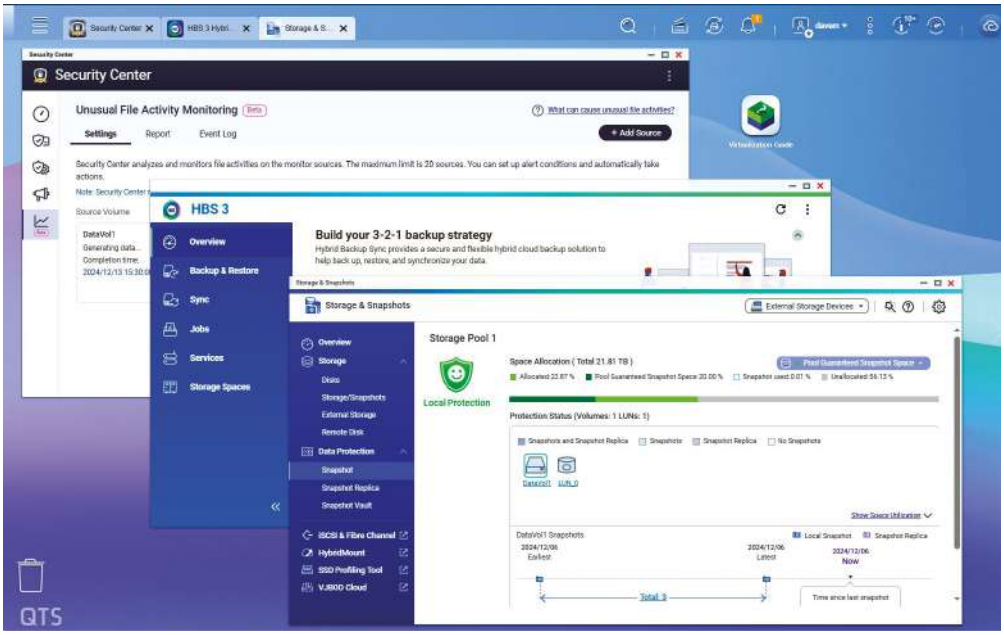
To test 2.5GbE performance, we hooked the appliance up to the lab's Zyxel XS1930-12HP 10GbE multi-gigabit switch. A NAS share mapped to a Dell server connected over 10GbE returned Iometer sequential read and write rates of 2.1Gbits/sec and 1.9Gbits/sec respectively.

Real-world speeds were in the same ballpark, with drag-and-drop copies of a large 25GB file between the appliance and server delivering sustained read and write averages of 2Gbits/sec and 1.7Gbits/sec. Securing a 22.4GB folder with 10,500 small files to the share mustered a tidy 1Gbits/sec throughput.

IP SAN performance was very similar to NAS speeds, with a 1TB iSCSI target returning Iometer read and write rates of 2.1Gbits/sec and 1.8Gbits/sec. Ramping up to a dual 2.5GbE MPIO link to the target proved to be challenging, with read and write speeds only increasing to 3Gbits/sec and 2.7Gbits/sec, while CPU utilisation peaked at 90%.

It has limited upgrade potential, but the TS-433eU offers space-poor SMBs an entry-level storage solution at a sensible price. Performance over 2.5GbE is good enough for light to medium workloads, the QTS software provides plenty of data protection apps, and the appliance's low-profile chassis is small enough to neatly tuck away in a wall cabinet.

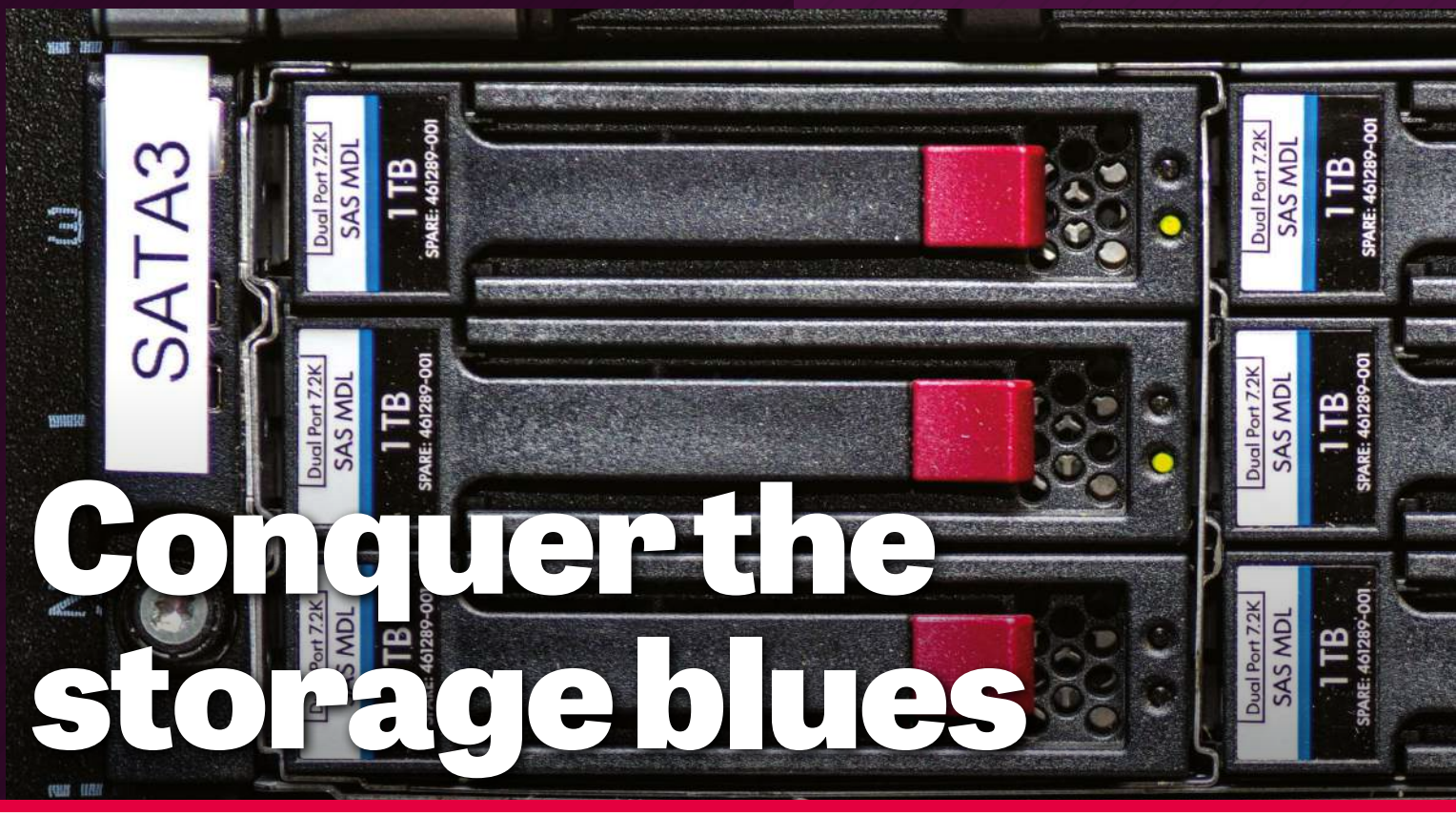
DAVE MITCHELL



BELOW **Along with an unusual file activity monitor, QTS offers backup and snapshot data protection**

SPECIFICATIONS

1U rack-mount chassis • 4-core 2GHz Arm Cortex-A55 CPU • 4GB DDR4 (max 4GB) • 4 x LFF/SFF hot-swap drive bays • 2 x 2.5GbE • 2 x USB-A 3.2 Gen 1 • internal 60W PSU • 430 x 292 x 43mm (WDH) • 2yr hardware warranty.
Options: RAIL-S01 kit, £67, TR-004U disk shelf, £388 (both exc VAT)



Conquer the storage blues

As data stacks up, every business needs a storage strategy. Steve Cassidy looks at ways to manage your megabytes

Almost everything a business does generates data. So it's entirely possible – even quite likely – that at some point you may abruptly and painfully run out of storage space. This isn't a concern that's always taken seriously, because avoiding it seems like almost the simplest job in IT: just stack up some more disks, job done.

However, if you take a closer look around, you may find that storage doesn't scale up in the way you think it should. Older enterprises may still be relying on expensive boxes, with dedicated, special-purpose drives inside and six Ethernet ports on the back. These drives do the same job as cheap, generic SATA disks, but they're coded to work with the supplier's own NAS hardware – so while they're technically hot-swappable, you can't just replace one with a reclaimed disk from a decommissioned desktop, or bulk-buy a cheap batch of spares. You'll have to pay whatever price is demanded for the approved drives, wait for however long it takes for them to arrive – and hope that support continues for as long as you need it.

This kind of protectionist approach is why many businesses have turned to cheap and cheerful desktop NAS systems. Unfortunately, these bring plenty of issues of their own. One thing that can be said for an enterprise NAS is that you can use it right off the bat, more or less; with a self-build device, configuring and reconfiguring your arrays can take days.

More to the point, these smaller, friendlier devices aren't built for the demands of a larger office. I remember one company that centralised all its operations on a little two-drive Buffalo NAS, expecting it to host about 100 roaming profiles for Windows PCs. Inevitably, this task required far more memory than its logic board could accommodate: every morning, as people arrived for work and all started accessing their profiles, it would be called upon to serve up thousands of tiny files at once, and would end up totally overwhelmed.

The truth is, most of us think about storage in entirely the wrong way. Our experience of desktops and the like leads us to focus on the size and speed of the storage media, but in fact it's almost everything else that determines the real limits to your capacity, performance and longevity. If you're shopping for a NAS appliance, I can't stress enough how important it is to choose one with upgradable memory slots, a reliable networking chipset from a major brand, and a CPU with not just enough megahertz but enough cache to handle prolonged periods of high demand.

"The practice of tiering derives from the very basic observation that all forms of storage have strengths and weaknesses"

It's also worth looking at some of the processes and practices the big guys use to handle storage issues, a topic we'll discuss below.

Setting quotas

Per-user storage quotas date back to the days when your entire business might run off a server with a 40MB hard disk – but they're still available in all server operating systems, and some businesses implement them aggressively. I've visited places where individuals had network storage quotas as low as 500MB; anything in this repository would be thoroughly backed up and made available around the globe, but the user had to figure out what data was important enough to warrant that treatment, and what wasn't.

Quotas are an increasingly tough sell, however. Users aren't

BELOW Make sure you buy the right size of NAS to meet your office needs

used to scrimping on storage (not helped by applications that happily generate enormous data files); if you tell them they can't dump their whole working data set on the network drive, they'll just stick it on Google Drive or a USB flash drive instead, and all your data protection and backup systems go out of the window.

Deduplication

Properly implemented, deduplication is a wonderful thing. The server storage device identifies when identical blocks of data exist in two different files, or across two different user profiles, and only stores a single copy of the relevant ones and zeros, with all other files simply containing pointers to that canonical source. The efficiencies can be enormous: think of a company with a one-megabyte logo that features at the top of every memo, letter, order and invoice.

Identifying candidates for deduplication can, however, be resource-intensive. You won't find this feature on inexpensive, consumer-grade NAS boxes. It's more commonly associated with a mesh of semi-autonomous, high-spec drive servers, with their own configuration and management.

Deduplication also gets complicated with resilient storage architectures, as the "store once, refer many times" model completely clashes with the idea of retaining multiple copies of everything as safeguarding against failures. This is before we consider the complexities of versioning and storage tiering – so let's talk about that latter idea now.

ABOVE Some enterprise storage systems only work with "validated" drives

Tiering

The practice of tiering derives from the very basic observation that all forms of storage, from old-school tape drives up to the latest NVMe SSDs, have strengths and weaknesses. NVMe is great for ultra-fast storage, but it's expensive and can get very hot in use. Tape drives conversely are very slow, but the media is dirt cheap, and they don't need fans. We could draw a whole matrix of good news/bad news attributes for all types of storage, old and new, and the conclusion would be that a whole range of assumed-obsolete technologies still have some specific advantages over the newest technology.

This is where tiering comes in. Rather than trying to keep all your eggs in any particular basket, a tiering system knows the strengths of your

Where did all our space go?

Until recently I would probably have tended towards the unsophisticated view that most storage problems can be staved off, if not solved entirely, by the infinite adding of more and bigger disks. But then two very different clients ran out of space at the same time, for totally different reasons.

The first set of clients will not mind me calling them the Brazilian Drag Queens, because that's what they are. With a textile studio in Camden, a shop in Covent Garden and little specialism in technology, they carried blithely on as their boss made a semi-arbitrary decision that their clothing catalogue would no longer use Photoshop to simulate pictures of clothes in varying colours: if a material were available in 30 shades, they would shoot and publish 30 real pictures of 30 real garments.

Indeed, there was some support for this decision, because with the best will in the world, digitally retouched colours don't always resemble the real-world item – but hardly anyone was nodding in sympathy after the raw files from their first real, physical photoshoot were delivered. They came on a USB storage unit the size of one of those robot vacuum cleaners that cats sit on; it even sounded like a Roomba, thanks to the integrated cooling fans.

As well as being physically enormous, this device had more capacity than all the disk storage on the network put together – along with the slowest transfer speeds in the building. The in-house IT helper merrily plugged it into the server USB and ran straight into a classic storage nightmare: not only did it take ages to mount the volume, every other operation then slowed to a crawl as the server painstakingly worked its way through the mass of pictures and generated the thumbnails, which nobody up to that point had seen any reason to disable.

The second set of clients were engineers. These guys were supremely confident about their old HP server setup, and quietly proud of the fact that it hadn't needed replacing in many years – all that had been needed, they told me, was an occasional disk upgrade to the SATA RAID farm. It wasn't even necessary to shut the old machine down for this; they'd been taking advantage of its hot-swap support to replace failed drives, writing the start date of each drive's active service on the casing of the unit. That's how I could see that, as well as filling up more quickly than expected, some of their disks were failing after less than a year's service.

Without making too much of a fuss, I set up two big Dell NAS servers as iSCSI targets and duplicated the whole thing over, being happy to take the hit on network performance just to have some backup copies safely outside the casing of the aged server. Shifting the files to the iSCSI machines was initially laborious and slow, but once we came to the email repository an explanation for the missing space and high failure rate became clear.

It turned out that their mail server wasn't a mainstream product, and didn't use a database: rather, it used a single socking great folder to store everything in. Messages, attachments, you name it, everything was there in plain sight, available to be freely browsed in Windows Explorer. That wasn't the worst of it, though: that was the thousands – probably tens of thousands – of TMP files, of all sizes and uses, interspersed between all those vital, irreplaceable emails. Attempting to import all this chaff into Exchange Server resulted in nothing but warnings and word salad, with the whole process taking so long that it began to markedly intrude on the working day.

So I turned to my safe copy of all these files and, following a hunch, deleted all files ending in TMP. This worked like magic. It turned out that simple directory traversal operations (opening a file, searching for text and so forth) had been causing the server to spend almost all of its CPU cycles iterating through these huge numbers of tiny files, not merely affecting its performance but also incurring considerable wear and heat generation on the drives. No matter how many drives were added or how often they'd been replaced, they'd never have matched the space and performance gains I was able to get with a single shell command.

different storage media, dynamically moving data to the most appropriate place based on predicted usage. Ancient files that no-one ever touches will be shunted onto tape, while hot data will be located for the fastest access – potentially even in a RAM disk. All of this is invisible to the user, who sees everything as occupying a single network storage location, while the middleware moves the data around in the background.

Clearly, tiering doesn't reduce your total storage requirements, but it does mean you can get by with a modest amount of top-speed storage, and keep everything else in cheaper locations, without slowing your everyday processes to a crawl. Indeed, while tiering systems themselves are expensive, once you're working with enterprise-scale quantities of data, tiering becomes the only practical way to survive the high demands put on your server suite by heavy-duty applications such as VDI, which breeds enormous VM image files, and then expects to be able to copy them around on demand as a user accesses their virtual desktop PC image.

And finally – cloud

The promise of the cloud was always about hosted computing resources, not storage. After all, your internet connection is probably the slowest data pipe in your entire organisation, so how could it make sense to put the information you need to operate at the other end of it?

But of course a remote CPU needs to be able to access your data, so if you're using any sort of cloud platform then it's impossible to avoid the need for at least some online storage. This inconvenient fact has paid for a lot of Teslas and holiday homes, because absolutely everything you do on a cloud VM is chargeable, not just uploading files but downloading them again, and deleting them, too. The alternative is to have a VPN pipeline back to home base and let your cloud resources access your local storage via iSCSI, but even then you'll pay for the VPN traffic, not to mention the CPU time spent dealing with encryption and data transport.

Of course, cloud storage does have its benefits, in particular scalability. If your problem is that you never know how much data you're going to need to process from one month to the next then the cloud could be the perfect answer. As we all know, though, it's far more common to have a large mass of data that just keeps on growing. Paying for cloud storage means you never need to worry about the physical media or infrastructure, although you'll still be paying for it indirectly.

Indeed, it's fair to say that, for many companies, the whole appeal of the cloud is that you can, nominally, forget about planning – but this approach is likely to earn you a visit from the finance director. It's much better to throw up flags internally the minute you have an issue (or ideally the minute you see one on the horizon).

ABOVE High-end storage servers save space with deduplication

It's also important not to underestimate your future requirements. I'm forever warning IT guys not to ask for too little – not just for their own benefit but for that of the business. It's far more efficient and effective to have a big storage project (say) every five years than to keep thinking in 90-day or annual spending rounds.

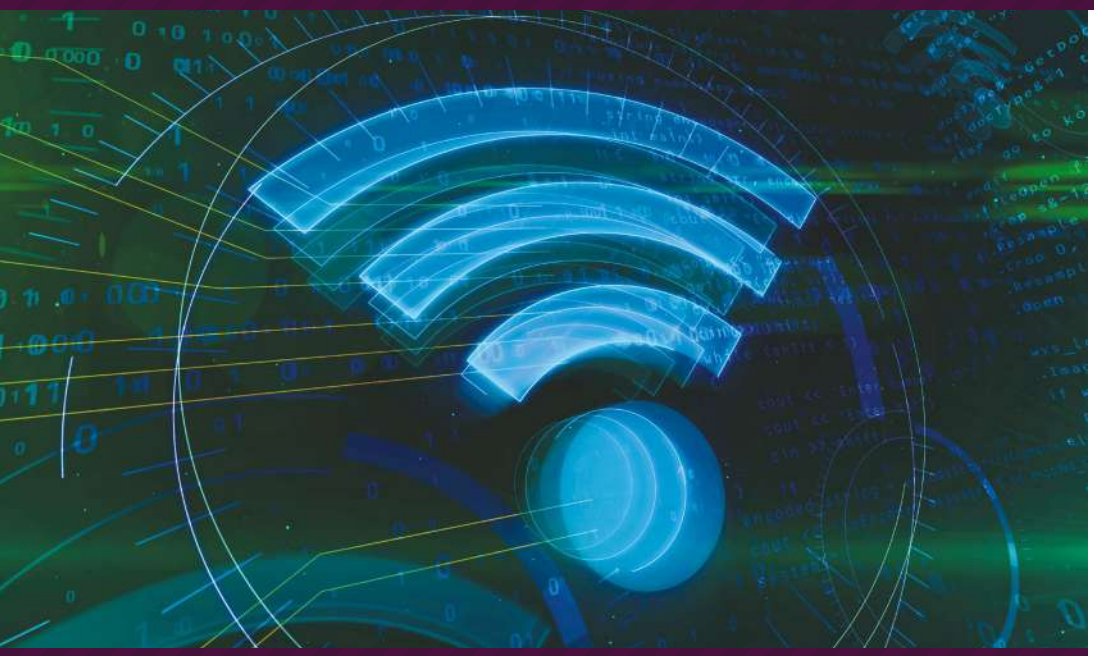
"It's far more efficient to have a big storage project every five years than to keep thinking in 90-day or annual spending rounds"

Stuck in the middle

Storage woes can often be a growing pain that hits medium-sized businesses the hardest. Tiny startups can muddle along with external USB hard disks and a shared Google Drive account, while the largest companies can afford to throw as much money as needed at local or cloud storage. Or indeed both.

It's we battlers in the SME sector who face the biggest challenges. With limited resources and ever-growing demands, we need to make difficult judgment calls, not just about raw quantities of storage but about how and when to upgrade the infrastructure and which of the aforementioned strategies to employ in a bid to keep things manageable. While drives get ever faster and cheaper, we're producing more and more data at accelerating rates, and we need to keep running as fast as we can just to stay in the same place. ●

BELOW Cloud storage has its benefits, but tread carefully here



Wi-Fi 7 for business

Should you be upgrading to the latest wireless standard? Steve Cassidy explores the benefits – and the limitations

So, is it that time again when we need to upgrade our network to keep up with Wi-Fi standards?
You don't *need* to upgrade to Wi-Fi 7 yet – nor ever. Doing so could bring benefits for performance and reliability, but Wi-Fi 6 is plenty fast enough for most desktop roles, and as long as you're already using WPA3 authentication, there's nothing new in Wi-Fi 7 on the security front.

Well, that's good to hear. But if we do choose to upgrade, are we looking at a major project?
It doesn't have to be an all-hands-to-the-pumps undertaking. A Wi-Fi 7 base station will happily work with slower, old-tech devices – although they won't get the fastest connections – so existing laptops can serve out their lifespan, and you can replace them with Wi-Fi 7-compatible ones when the time comes to retire them.

Can we replace our existing mesh system with a single Wi-Fi 7 router?
Probably not, I'm afraid. Wi-Fi 7 doesn't increase signal strength or directly improve round-a-corner propagation. Compatible devices may see a boost in performance or reliability thanks to Wi-Fi 7's ability to communicate across multiple frequency bands at once, but if you want to completely fill your premises with signal you may need to look into a different model, such as 5G.

Is it better to slot Wi-Fi 7 into our existing infrastructure, or to start afresh?
I never like to dismiss any suggestion of a clean redesign of a network. Most businesses could benefit from one, and in this case the signature benefits of Wi-Fi 7 are only fully accessible if you dump your old setup in the bin.

That doesn't mean you need to excise Wi-Fi 6 from your premises, though: if only half of your machines are accessing the network more quickly, that means they get off the air faster, increasing availability for the rest.

Are there any major downsides to running a Wi-Fi 7 router in parallel with older hardware?
My one note is the same one I have about all Wi-Fi deployments: some security features are part of the over-the-air signals standards, while others are implemented in the IP layer, and only protect devices that use the router as their gateway. So if you want your new Wi-Fi 7 router to provide network security, that's going to push your buying pattern in the direction of more new devices, sooner rather than later.

What about other technologies, such as VPNs and IPv6?
Strictly speaking, neither VPNs nor IPv6 are anything to do with Wi-Fi 7. They're several jumps up the diagram from the wireless connection, so there should be no inherent issue running these services on any version of Wi-Fi. Of course, that doesn't guarantee they'll be implemented by all routers, but if you come across one that lacks these key features, I'd suggest walking away for that reason alone.

It sounds almost as if Wi-Fi 7 isn't actually all that necessary?
I wouldn't disagree with you, in terms of what the technology is capable of compared to Wi-Fi 6. However, replacing increasingly dusty router hardware with newer kit offering the latest features and quality is rarely a bad idea – especially when doing so also gives you an opportunity to unpick all the messy static routes, user hacks, port redirection fabrics and so forth that have accumulated over the years, and to replace them with something as clean, fast and reliable as is achievable with the latest hardware. ●

Wi-Fi 7 vs Ethernet

Much has been made of the performance of Wi-Fi 7 – it's officially subtitled "Extremely High Throughput", and on paper it promises connection speeds of up to 46Gbits/sec. That's fast enough that you might be wondering whether it could entirely replace your wired infrastructure.

In reality, though, that number comes with some significant caveats. For one thing, wireless ratings like this represent total throughput, not per-client speeds: if you plan to connect 20 devices, expect your bandwidth to be divided up 20 ways.

It's also important to understand that 46Gbits/sec is the theoretical maximum the Wi-Fi 7 standard is capable of. In the real world, the fastest Wi-Fi 7 router we've seen – the Netgear Nighthawk RS700 (*see issue 353, p76*) – claims a top data rate of 19Gbits/sec. Even this isn't realistically attainable in use: attenuation and interference will slash connection speeds for devices that aren't situated right next to the router.

In other words, Wi-Fi 7 may not be any faster than a gigabit Ethernet connection – and there's very little chance of it competing with a 10GbE link. It may still be fast enough for your business, but you should also consider the unbeatable reliability and security of a physical connection before you start ripping out your Ethernet cables.

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Real world computing

Expert advice from our panel of professionals

JON HONEYBALL

"As a product test lab that specialises in technology such as Wi-Fi, it's important that we're at the bleeding edge"

Whether it's wired or wireless, the latest developments in networking speed and reliability might prompt you to make a big upheaval. Here's one man's story on doing exactly that

After years of very solid service, I have moved away from pfSense running on a dedicated Netgate gateway appliance at the lab. Why move away from such an illustrious and well-regarded platform for the core lab network? Well, let me first say that pfSense is a superb piece of work – I have no qualms about using it again. It's supremely flexible and has a wide range of add-on packages that you can install and tweak to get it working just how you want.

The problem is that I am not, and never have been, a pfSense nerd. I have relied on the default configurations to work well, and they have. And that isn't just a matter of trust: I have poked and probed it on both the LAN and WAN sides with serious tools such as Nessus, and it has a clean bill of health. Setting up VPN tunnelling was pretty straightforward, likewise managing DHCP and IP reservations.

But it is nerdy. And I had to make a choice: stick with the Netgate/pfSense combo or change to something that would integrate better with the lab's wider hardware and software stack.

As I've said before, I'm a big fan of the UniFi platform from Ubiquiti. I use the £480 Dream Machine Special Edition at home, where it interfaces with the Gigaclear fibre and Starlink (the latter as live failover). But now Ubiquiti has launched the similarly priced Dream Machine Pro Max.

This is quite a monster that supports many hundreds of clients and devices. To be fair, I was a long way short of maxing out the DMSE unit, but my experience with this on the home LAN gave me the confidence that a Dream Machine could work at the lab and would inherit the existing network fabric from a rather old and tired Ubiquiti CloudKey+ unit. The kicker would be the really easy integration and day-to-day operation that the UniFi platform brings.

I bought one when it was announced, but I had to wait until the Christmas shutdown before I was brave enough to attempt this level of surgery on the network. Not only did all of the UniFi devices need to be migrated, a task that is actually incredibly simple, but I also needed to consider more sticky issues with DHCP MAC address reservations. I couldn't find an easy way to export the DHCP list on the pfSense box; I'm sure I could do it from a command line, but this seemed boring. In the end, I simply copied the DHCP data from the pfSense configuration web page and pasted it into Excel, which fortunately made a good job of formatting it nicely.

The switchover was simple enough, and within minutes the network was up and running. I have made some appropriate security tweaks, including blocking the IP addresses of certain countries and instigating a good level of live monitoring.

So far, I'm pleased. I could link two physical units together in a full failover, taking the failover from the port level to the whole device level, but that's overkill for me. The unit is in a rack in a nearby data centre with dark fibre between the lab and the DC, so this is already provably robust.

I see Ubiquiti also sells a new Enterprise Fortress Gateway with 25Gbits/sec connectivity, a significant step up from the 10GbE on the Dream Machine Pro Max. But I can't really justify that, despite it supporting 5,000+ clients and 12.5Gbits/sec routing through the packet inspection engine.

Jon is the MD of an IT consultancy that specialises in testing and deploying kit
@jonhoneyball

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Connect multiple branch Sites to a centralized Hub.
Up to 1000 Sites
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Directly connect all Sites together.
Up to 20 Sites
Get Started

RIGHT Site Magic SD-WAN allows you to join two networks together seamlessly

BELOW Ubiquiti's Dream Machine Pro Max supports hundreds of clients

Jon Honeyball
Opinion on Windows, Apple and everything in between – p110

Lee Grant
Tales from the front line of computer repair – p111

Dr Rois Ni Thuama
Risk analysis from our expert in cyber-governance – p116

Davey Winder
Keeping small businesses safe since 1997 – p118

Steve Cassidy
The wider vision on cloud and infrastructure – p120

There's one last party trick that these UniFi routers support: SiteMagic SD-WAN. This allows you to seamlessly join two separate networks together using a VPN tunnel across the internet. It really couldn't be simpler: choose the sites and press the go button. It just works and is a superbly simple and controllable solution for site-to-site connectivity.

I could manually set up the necessary protocols to do site-to-site VPN tunnelling, and indeed I had done this on the pfSense box, but the Ubiquiti platform makes it really simple, and I created a three-site mesh connection in under ten seconds. You can't ask for easier than that. I've looked at solutions like Tailscale, too, and although it has much power the Ubiquiti solution meets my needs.

There are two configuration options: a hub and spoke system or a fully meshed design. Hub and spoke will allow for up to 1,000 sites and is ideal if you want a master headquarters (or data centre hub), and then a number of spokes at branch sites. With the mesh solution, you're limited to 20 sites, but that will be more than enough for the smaller end of the small to medium enterprise marketplace.

To enable remote VPN tunnelling from laptops and phones, I also needed to have a full VPN server set up. This is very easy to do using the WiFiman tool provided by Unifi. Again, it's one click to enable and join onto the network, whether that's from a laptop or phone. I also needed an OpenVPN server on the main lab network for one team member to join in; this was very simple to enable, sending him the .OVPN configuration file along with appropriate username and password.

Enter the E7

All of which leads me to the E7 **(tinyurl.com/366ubiqe7)**.

As a product test lab that specialises in technology such as Wi-Fi, it's important that we're at the bleeding edge of what's happening there. To be honest, almost nothing beats the raw throughput of an older Netgear RAXE500 unit, and that's only 802.11ax Wi-Fi 6E, not 802.11be Wi-Fi 7. It can happily give you just shy of 1.9Gbits/sec of user data throughput if you're nearby.

10-stream WiFi 7 access point
10 GbE uplink
Status LED light
250 mm
250 mm
Tri-radio 2.4 / 5 / 6 GHz
185 m² (2,000 ft²) coverage
1,000+ connected devices
43.5 mm
Real-time spectral analysis for enhanced channel selection
GbE PoE++ in RJ45 port for power & data redundancy
Compatible with UniFi Pro Mounting System
Reset button
10 GbE PoE++ in RJ45 port

Move two rooms away, and the consequential drop in signal strength by about -25 to -30dBm knocks that down to around 400-500Mbits/sec even on a client device that has excellent aerial design.

So far I've been somewhat underwhelmed by the 802.11be Wi-Fi 7 implementations out there, and can't get past the magic 2Gbits/sec speed barrier. Obviously, you need to ensure that the connected backbone is capable of handling this, so 2.5GbE switches are the minimum. I actually use 10GbE switches, and the performance test server uses 10GbE ports on a card from Intel. I know this can deliver about 9.7Gbits/sec of user data when you connect from an appropriate 10GbE port on a fast laptop, usually using Thunderbolt.

Anyway, the E7 is an enterprise-grade indoor access point that supports Wi-Fi 7, despite its £380 exc VAT price. It has a 10GbE port for its connectivity and a secondary 1GbE port for data and power backup purposes.

This left me with an intriguing problem. The E7 requires Power-over-Ethernet, and specifically PoE++, which is a whole big step up from the usual PoE+ specification. It will run on PoE+ but whines that it's cowering in the corner due to a lack of oomph.

I could have gone for a split power option, pumping in the PoE++ on the 1GbE port and having the data on the 10GbE port. But where's the fun in that? I went hunting for a 10GbE PoE++ solution. Turns out they really don't exist, and only hugely enterprise-sized switches can support both on the same port. And even those are rare.

So the obvious solution was to find a PoE injector that could sit between the switch and the E7, and inject the necessary juice onto the wire. Now you might think that any PoE++ injector would do the job, but you'd be wrong; almost every injector is limited to 1Gbit/sec network speed. I needed the Holy Grail of 10GbE and PoE++.

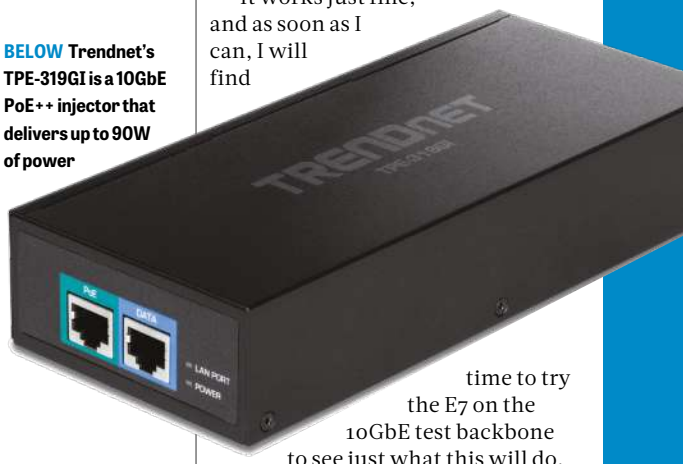
And I found it! Trendnet makes a 10GbE PoE++ injector that can deliver up to 90W of power called the TPE-319GI. This seemed like fun, so I ordered one from Amazon for around £85 exc VAT including delivery.

It works just fine, and as soon as I can, I will find time to try the E7 on the 10GbE test backbone to see just what this will do. As a starter, it supports multi-link operation (MLO), which will bind multiple Wi-Fi radios together (for example, 2.4GHz plus 5GHz, or 5GHz plus 6GHz) to really maximise the throughput. Some devices support this today, too. It will be interesting to see what the absolute state-of-the-art Wi-Fi unit will do when stretched.

Ubiquiti even claims it will support ten spatial streams and over

ABOVE The E7 is an enterprise-grade indoor access point that supports Wi-Fi 7

BELOW Trendnet's TPE-319GI is a 10GbE PoE++ injector that delivers up to 90W of power



"I needed the Holy Grail of 10GbE and PoE++. And I found it!"

LEFT **The UniFi Flex switch has four 10GbE ports, as well as an Ethernet port**

1,000 concurrently connected devices. That latter point is actually very hard to test unless you have a large populated area such as a train station or conference centre. But that's the target for this device, and I can't wait to stretch its legs.

Switching switches

Talking of 10GbE, I mentioned the test backbone we use which has 10GbE switches. These are quite straightforward units, namely the Netgear ProSafe XS508M, which is an 8-port 10GbE switch with a fibre port that takes a standard SFP connection. But I have an issue with this switch, which is that it just hangs. All the LEDs come on and no traffic flows. Reboot it, and often it won't come up cleanly at all, sitting at the "all LEDs on" stage.

Now I might have dismissed this as a hardware failure on this unit, but for the fact that I also have the identical 5-port version, the XS505M. And this does the same thing. Powering down the switch to let it calm down sometimes helps, but not always.

Some suggest that it's a crash in the components that drive the SPF port, because I often use an SFP-to-SFP interconnect cable between this switch and the rest of the network. But I've had the issue using Ethernet cable interconnectivity as well. There are quite a few threads on various fora about this issue, but no-one has a definitive solution. And because both are plain unmanaged switches, there are no obvious firmware updates available.

The solution is probably to throw a little money at the problem and buy another UniFi Flex 10GbE switch. This has four 10GbE ports, along with an Ethernet port that can be used to power the switch over PoE using a handy USB-C port. I know this works well, because I have one on my desk at the lab, connecting up 10GbE on my desktop machines across to the 10GbE backbone switch.

This would be ideal but for one problem: I need more than four ports. One for the test server that hosts OpenSpeedTest and iPerf; one for the uplink to the wider network; and three units if we're testing a three-way mesh system that relies on Ethernet backbone. I could buy two and stack them up, but that isn't a clean solution either. I might need to buy another two of these Trendnet PoE++ injectors, so I can power up a three-way mesh at 10GbE with appropriate power. Sometimes things are just too complicated for my brain.

"Sometimes things are just too complicated for my brain"

Going bananas with OpenWRT

Looking for a nerdy router that gives you the opportunity to really configure everything? Down to being able to compile your own firmware/operating system?

Then look no further than the Banana Pi OpenWRT One development board in a box. Inside sits a board based around the MediaTek MT7976C system on a chip. There are three aerials, two Ethernet ports (one WAN port, which goes up to 2.5Gbits/sec, one LAN port, which runs to 1Gbit/sec) and a USB-C port for power input. You can also power it via PoE from a downstream LAN switch if you like.

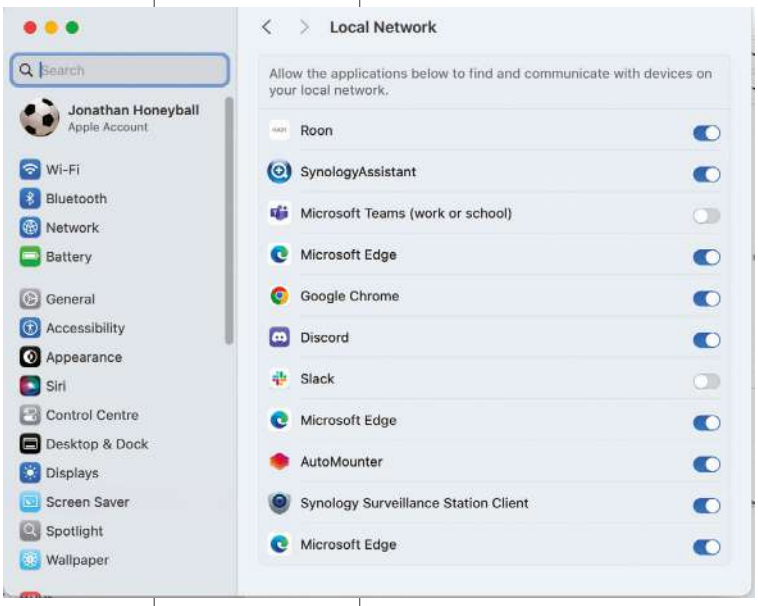
The OpenWRT operating system has been around for years, but here it's pre-baked ready for this hardware. Or you can take the source and reconfigure it to your taste. In terms of wireless, it supports 802.11ax Wi-Fi 6 on 2.4GHz and 5GHz, so it doesn't have a 6GHz radio, but we can easily forgive that.

Setup is pretty easy once you remember that this is OpenWRT so it's aimed more at nerd hobbyists than my gorgeous Aunt Helene. Nevertheless, the GUI is quite straightforward and I had no problems bringing up the Wi-Fi interfaces with appropriate security, and ensuring it was connecting to the WAN side with no issues.

So what's the upside? It's a perfectly decent board in a nice shiny dark blue case. It has OpenWRT, which is extremely well understood and is open source, so ongoing support won't be an issue.

Best of all? It was around £80 delivered from AliExpress. Delivery took a week or two but was painless. And so far I think it's really cute and certainly delivers on the price/performance promise. It's the entirely opposite end of the scale to the app-controlled modern Wi-Fi routers that mainstream vendors sell, and then often fail to support correctly. For that, it is a breath of fresh air.

BELOW **The Local Network setting in macOS can be toggled on and off**



BELOW **The Banana Pi OpenWRT One: a nerdy router that lets you configure everything**

Upsetting Mac settings

It was one of those annoyances that I had to track down and fix. On my Mac desktop at work, and my old, tired but still fully functional MacBook Pro at home, I couldn't get into the web configuration pages of local servers using the Microsoft Edge browser.

I could ping them from a command line. But getting to the HTTPS

page didn't work. I tried a different browser and had no such issues.

At this point, it was clear to me that a security setting had gone awry. So, I dived into the deep and complex mess that is the settings within Edge, to see if there was an obvious switch that needed flipping.

I found nothing. Which, of course, made me even madder and determined to find the solution. This required a bucket of coffee, and then another. If I may quote from *The House on Pooh Corner*, "It was still snowing as he stumped over the white forest track, and he expected to find Piglet warming his toes in front of his fire, but to his surprise he saw that the door was open, and the more he looked inside the more Piglet wasn't there."

My Edge settings were open in front of me, and the more I looked, the more any obvious security setting wasn't there.

And then a thought struck me – maybe it wasn't Edge itself that was doing the blocking? Maybe it was the firewall, which can usually do app level filtering? But no – the firewall service wasn't running on this laptop. It never goes onto an unknown LAN so it isn't an issue, although obviously it's good to have a firewall running when you're out and about.

If it wasn't the firewall, what else could it be? I finally had the light bulb moment. MacOS, like most modern operating systems, allows you to control network access on a per app basis, but it's down in the Privacy & Security settings under the System Settings app. And "Local Network" is one of the settings that can be toggled on or off. There was the answer: for some reason, Edge had local network access switched off. Enabling it let me get to all my lovely 10.x.x.x servers, and normality returned.

The moral of the story? Don't assume the setting you need is within the app itself. There's now a whole raft of system-level configurations that directly and individually impact how apps run. Other examples here are "Microphone", "Camera", "Bluetooth" and, my favourite, "Screen & System Audio Recording". Without which you might find your Microsoft Teams or Zoom app having a working camera but no sound.

jon@jonhoneyball.com

LEE GRANT

"I think of myself as the Artful Bodger, a grubby-faced urchin that picks the pockets of OEMs"

After acquiring faulty parts, a PC repair shop hopes that the repair economy will be more profitable than setting fire to the cash in the till

The year 2025 has begun with the traditional bedlam and financial ruination of repair-based retail. By striving to fix the unfixable, I think of myself as the Artful Bodger, a grubby-faced urchin that picks the pockets of wealthy OEMs by denying them a sale.

This year, my job should get easier. More Right to Repair legislation went live on 1 January and, if the EU can finally agree what day it is, by the end of the year there should be clarity on user-replaceable batteries for devices larger than mobiles and tablets.

I'm excited about the potential of these changes and look forward to reading *PC Pro* reviews where the availability and pricing of spare parts will affect the final score.

Despite the new laws, change won't be instant. For decades manufacturers have avoided repairability like a president avoiding a tax bill, so until 2025 makes a real-world impact, our shop will remain its usual chaotic self.

Will the real battery please stand up?

I'm writing these very words on my Lenovo ThinkBook G2. It has an 11th Gen Core i7 (the Matt Smith), 16GB of RAM and Nvidia MX450 graphics, and is functionally dull. I acquired it in 2021 and despite a decent spec, it's always been sluggish.

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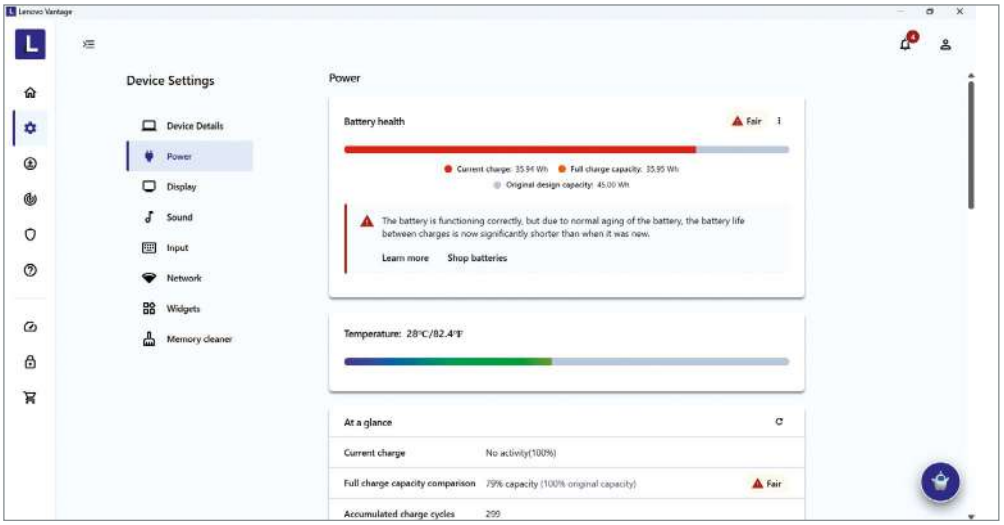
"For decades manufacturers have avoided repairability like a president avoiding a tax bill"

Battery life has been awful, too. Despite exploring Windows' power management inside out several times, there are days when I get 45 minutes while word processing. Lenovo's management software, Vantage, flagged that the battery health is now "fair" and presents a handy link to take me directly to the Lenovo parts store. This is how repair-retail should be done, and Lenovo gets full marks for removing the friction from the parts-purchasing process.

The fly in the ointment is that the Lenovo parts store doesn't sell a battery for my laptop. The page that Vantage pings up is trying to flog me a "cloverleaf" mains cable that slots into the charger. How much for the cable? As I write this, £32, which is rather pricey for a cable I sell for £4. If you think this is some kind of error then it's an increasingly profitable one, as the same cable in September 2024 was a bargain £28.

If we put blatant profiteering to one side, you may have spotted that Lenovo's presumably gold-plated, Swarovski-encrusted cable is not a battery. I'm going to make a huge presumption that Lenovo Vantage is



BELOW The battery on my Lenovo laptop was "fair", according to Vantage

showing me this cable-of-the-gods as the battery for my laptop isn't available in its store. If I access the parts for my machine via **pcsupport.lenovo.com**, I get different results (slow hand clap for Lenovo). It gives me three unavailable battery options which, in any situation, isn't particularly helpful.

Despite what analysts will tell you, repair-retail, especially with laptops, isn't like "normal" retail. Specificity and the availability of a specific component often overrules price. I can't just buy another Lenovo battery because it probably won't fit inside the chassis. This is different to buying an Nvidia RTX 4090 card where OEMs (basically) create variations of the same product. One may flash LEDs faster or have a different thermal/acoustic profile, but throw any of them into desktop and the machine will run. My laptop needs one of three batteries, none of which Lenovo can supply.

This is where the third-party market comes into play. There are plenty of reputable third-party battery suppliers around ("proper" as they say here in Yorkshire), and this is a positive thing. Late last year, a customer brought their Lenovo into the shop for a replacement battery as the factory-fitted one had died. As the user was a field engineer, using the machine in places without a 240V supply, this was a showstopper fault.

Lenovo also didn't have a battery for that machine, so I sourced a third-party version, which arrived next day and at a price that doesn't make you wonder if the accounts department is on hallucinogens. Job done? No. I installed the battery, pushed the power button and wept at the message: "The battery installed is not supported by this system and will not charge. Please replace the battery with the correct Lenovo battery for this system."

For clarity, there's nothing wrong with the third-party battery. This is a firmware block and a deliberate way to prevent repair. Thanks to Oregon's Right to Repair laws (and Colorado's beginning in 2026), this type of parts-pairing is forbidden, but until OEMs push BIOS updates, it remains a problem in the real world. Lenovo isn't the only one to employ this practice, nor is it unique to the tech sector, but until these blocks are removed, we can have all the spare parts in the world, but they can't be used.

How did I fix this laptop? I didn't. The customer bought an Acer.

Now for the bit of repair-retail that rarely gets talked about. I'd bought a part specifically for this customer's laptop, so I can't use it in another machine (see above). As consumer legislation such as the Consumer Rights Act 2015 doesn't apply to business-to-business transactions, my battery supplier isn't obliged to restock the part and my business takes a financial hit because of Lenovo's Byzantine firmware farce.

If the same customer had walked into the shop and, instead of asking me to fix their laptop, had asked for £50 from the till, I'd be better off than I am now. As you can appreciate, this glaring hole in business protection does nothing to promote a repair-economy, especially when the type of component gets more expensive.

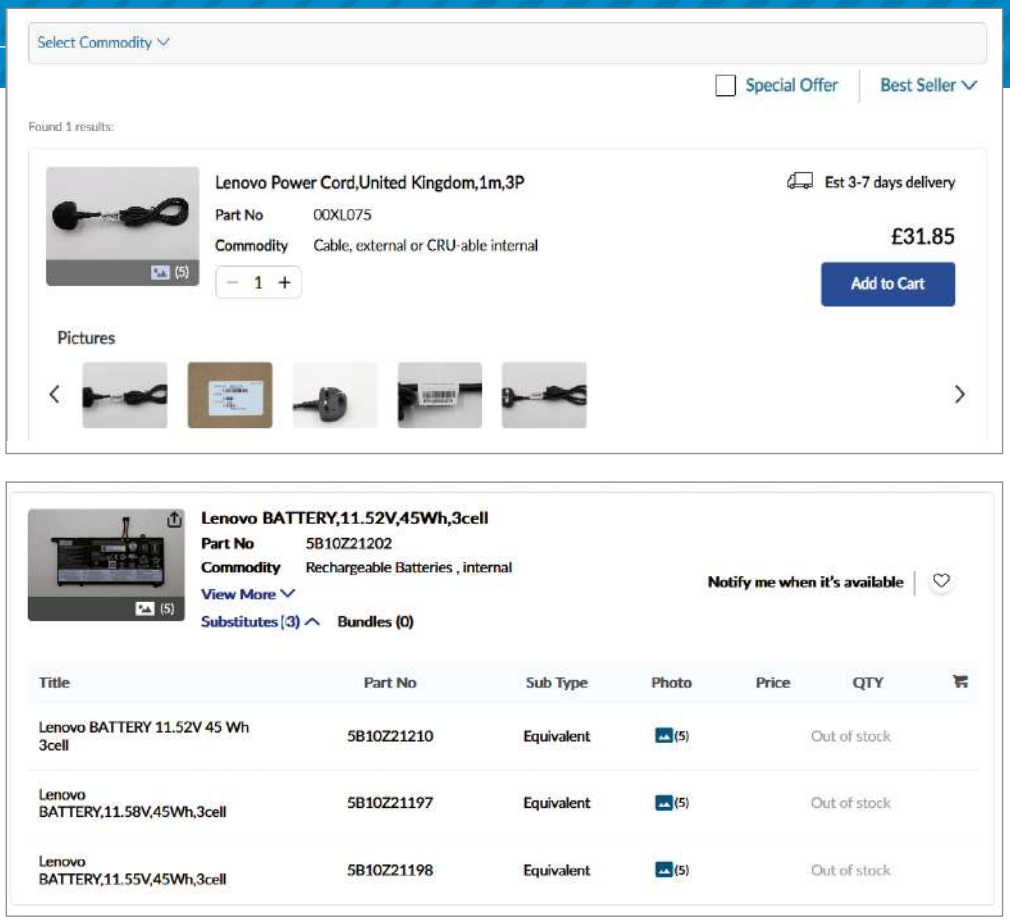
Two out of three ain't bad

At the start of the year, I built a PC for a customer using an AMD Ryzen 7 7700 APU. During the installation of Windows I'd noticed that our test bench monitor kept turning black, but I hadn't been too concerned. This happens on new builds as Windows plays "guess the driver" (it's very good at it) and various parts of the system refresh.

This system's motherboard was an ASRock B620M Pro, which has a handy utility offering to load various drivers once the install is complete. A genuinely useful solution in a post-DVD world. Once the ASRock drivers were on (and for clarity, I will refer to these as the OEM drivers), the party really started. The mouse couldn't control the interface, and the screen repeatedly froze. If you're playing along, then place your bets now as to what the problem was.

Given that the machine's OS was about a nano-second old, I ruled out a software glitch, so it was time to look at hardware. As it was the end of the working day, I booted into a multi-cycle MemTest Pro RAM diagnosis and left the machine to work its magic. In the morning, the RAM had passed all the tests. Next, I removed the brand-new SSD. Why? I don't want to put mileage on a new part while performing various test installs. It will also reveal if the issue is being caused by a stalling SSD.

I de-coupled the new PSU and wired in one of our known-working test units and, after that, there was only the motherboard and the APU left. I installed a temporary version of Windows 11 but didn't hook the machine to the internet to download drivers. The machine was stable but laggy; I ignored the OEM drivers and opted for the pucker real-deal AMD Adrenalin originals. On reboot, an AMD pop-up appeared stating that a driver timeout has been detected. This was positive as it confirmed that even AMD's software was detecting an issue, but with what?



ABOVE A replacement wasn't available, but I could buy a power cord for a bargain £32

"If the customer had walked into the shop and asked for £50 from the till, I'd be better off"

At this point it looked like the GPU component of the APU was faulty and, for once, luck was on my side. Sitting in boxes on the other side of the shop were the parts for another PC I was building that used the same APU and motherboard. I removed all my test parts (except the SSD) from the build, replaced the suspect APU, and the machine fired up with no AMD nags or stutters. I flattened the machine and tested with both OEM and AMD drivers, and all was well. For a flourish, when I built the second machine, I installed the suspect AMD chip and merry hell rampaged once more.

So if you guessed that the GPU of the APU was faulty, give yourself a point. I contacted my supplier, boxed up the faulty APU and sent it back for the supplier to deal with. And, as they say, this is where the story really starts.

Real-world repair

To ensure we hit the delivery date for our client, we sourced a replacement APU from an alternative trade supplier. I informed the original supplier that as the APU was dead on arrival, I didn't want a replacement but a refund or credit onto my account would be fine. This was refused. I was told that once the part had been tested by AMD (which can take up to four weeks) a decision would be made if there was indeed a fault to be found.

Currently, I've bought three APUs to build two machines. Once AMD has tested the suspect APU, a decision will be made whether I'll get a new Ryzen 7 7700 (which I don't want), a refund or credit (perfectly acceptable) or the suspect APU returned with "no fault found" (I've lost count how many times this has happened). There's a 50/50 chance that I will end up in a worse position than when I started. This isn't retail, it's gambling.

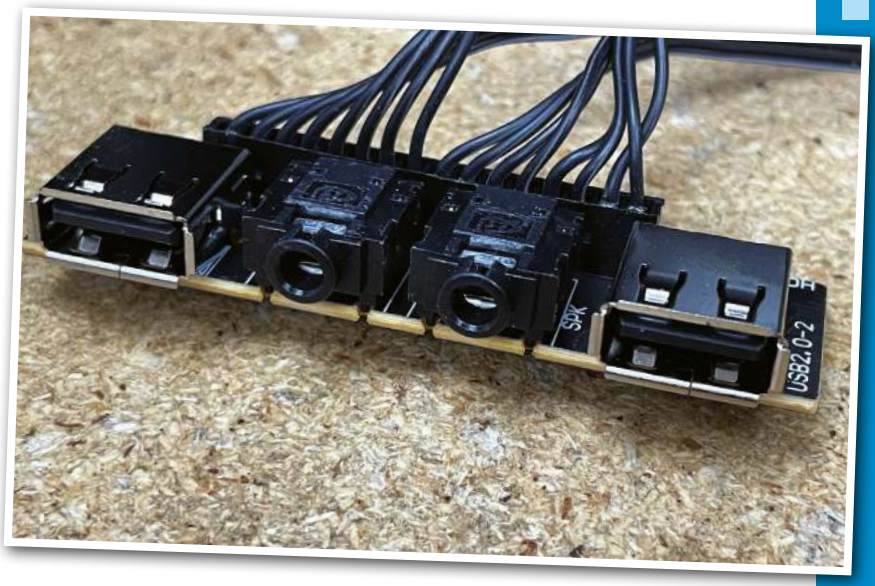
Why am I boring you with this dull insight into my business affairs? If you'd bought this APU from an online retailer, there's a 14-day cooling-off period allowing you to change your mind and get a refund. This is part of the Consumer Rights Act 2015, which governs the buying rights for consumers, not businesses. Technically, there are still parts of the Sales of Goods Act (1979) that cover business-to-business transactions, but the wording is so woolly that lawyering up is the expensive route to recompense. In short, the law is not on my side.

First, this isn't anything new and Alison and I have countless stories when we've been p****d on by a supplier who swears on their granny's grave that it's only raining. I haven't named the supplier as they are trade-only, but one of the driving factors for the Right to Repair movement is to help build a proper repair economy. This means that repair must mature from the volunteer sector into profitable, standalone businesses that can contribute to the economy and pay living wages.

Alison and I have done this for over two decades, and while our "living wage" is often circa 1625 rather than 2025, we're still here. For a repair economy to become a fiscally workable reality and not just the jargon of environmentalists, then the gaping void, where buying and selling rights for businesses should reside, must be filled with practical and enforceable legislation.

The real-world reality of bricks'n'mortar repair-retail is that consumer law puts the responsibility onto the retailer. A retailer who is not afforded the same protections against any of the tiers of multi-million-dollar suppliers/distributors/corporations – all they need to do is naff all while counting the profit for selling faulty products.

Repair-retail must be attractive to the consumer if any form of repair economy is to thrive. It needs to be as convenient as buying new while being cheaper, and the real-world nonsense I've mentioned makes it an unfairly tough business sector. Unrealistic business-to-business legislation from 1979 needs a radical overhaul. As Mr Bumble said, "the law is an ass".



ABOVE The USB ports in an Antec case ere soldered to a PCB at the top of the chassis

"While our 'living wage' is often circa 1625 rather than 2025, we're still here"

AMD Bug Report Tool
AMD software detected that a driver timeout has occurred on your system. An issue report has been created that can be sent to AMD to help us improve our software. Would you like to report this issue?
Don't ask me again (Disables issue detection)
Close
Report Issue

BELOW An AMD error message about a faulty APU is no guarantee of a refund

USB or not USB

That said, OEMs are not always the best people to supply spare parts. Last summer I built a desktop for a client using an Antec NX500M case. After a few months, the customer said that the front USB 2 ports were "intermittent". On the workbench, I confirmed the fault, although I couldn't work out if the customer's ham-fistedness (their own description) or Antec's "value" USB plugs were to blame.

The USB ports are soldered to a PCB that sits at the top of the case. Although Antec sells some spares for its products, the list is far from conclusive and is mainly fans and glass side-panels. Like all OEMs, Antec had built the case to a budget and I wasn't keen to buy more ports of this standard. The fix was to desolder the ports and replace them with quality versions made by Adam-Tech (**adam-tech.com**). As you may know from your own tinkerings, one of the pleasures of repair is not only the possibility of saving something from the skip but the opportunity to improve on the original and increase the quality of a product. The customer was surprised that a modern manufacturer was willing to supply the parts so I didn't disabuse them. Antec can thank me later.

Also, as the machine was under warranty, the customer wasn't charged, so if Antec's accounts department is reading, let me know where to send the invoice for repairing your product for free.

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ROIS NI THUAMA

"No-one is losing their life over infosec decisions and no-one should be losing their head"

Don't be daunted by the rapidly changing face of the security landscape – learn from those who climbed the southwest face of Everest instead

On an icy night in November 2018, I picked my way slowly around the snaking roads of north Wales through a flurry of snow. I was heading to the Moel Siabod café to meet friends – and listen to two of the greatest mountaineers describe the first ascent of the southwest face of Mount Everest.

Fifty years ago, as part of a British expedition led by Chris Bonington, Doug Scott and his climbing partner Dougal Haston became the first climbers to reach the summit via this new route. It was a remarkable achievement; it was an ambitious and challenging climb largely due to its technical difficulty and exposure to severe weather conditions. That evening, Doug Scott and Paul "Tut" Braithwaite, Britain's most prolific alpinist, shared with the audience what it took to scale what the Nepalese call Sagarmatha, the forehead of the sky.

You might well wonder why you are reading about climbing exploits in *PC Pro*. Bear with me, I have a point. Just before the world shut down in March 2020 to control the transmission of the then deadly coronavirus, I sat in Dublin and listened to the UK's first CEO of the National Cyber Security Centre, Ciaran Martin, deliver a presentation to a rapt audience of information security and fraud prevention experts.

Martin made the point that many businesses operated across a number of sectors that required detailed understanding of engineering (chemical, civil, electrical), programming, biomedical matters and so on, but whose leadership had not yet grappled with the fundamentals of information security. He wasn't wrong. The point was clear. Leaders could process complex information, but wouldn't engage in information security matters.

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"Why are so many business leaders failing to take steps to protect their interests?"

Grappling with complexity

Scaling Everest is a significant milestone in the history of human achievement. For most of us, unless you're a professional soldier, nothing we do at work will ever be as difficult or as dangerous as scaling a 29,000-foot mountain in sub-zero temperatures. For all the talk of cyber-war and sophisticated nation state actors, information security isn't more difficult than scaling the world's highest mountain. Securing information is, or should be, manageable. So why are so many business leaders failing to take the small but necessary steps to protect their interests?

If we consider Martin's point about leadership grappling with tough subjects and how a team successfully summited Mount Everest half a century ago, we should be able to offer insights into succeeding in tough conditions. If not, then at the very least it should provide some perspective.

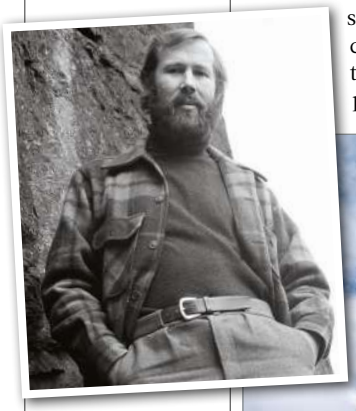
Because whatever decision infosec leaders and business leaders make at work, everyone gets to go home at night. Everyone. So yes, infosec is critical for businesses and yes it may be stressful at times, but it doesn't carry the same life-and-death stakes. No-one is losing their life over infosec decisions and no-one should be losing their head. In the words of the World War II motivational poster that now finds itself on tee shirts and tea towels: keep calm and carry on.

The story of the successful ascent of Everest is fundamentally about the importance of teamwork and team dynamics, careful preparation, effective risk management, continuous monitoring and responding to incidents. It exemplifies the importance of setting and achieving long-term goals through discipline and collaboration.

It's true to say that the cyber-threat landscape and legislative landscapes are shifting. But this is true of everything. New viruses develop and the world responds. Legislators are continuously drafting new rules. And the business world responds.

But in the context of infosec, the changes aren't occurring so dramatically that it's impossible to put people, tools or processes in place to address the changes. Many British businesses that look to the EU as a destination for their goods or services will need to comply with the new rules under the NIS2 directive.

Businesses that fall within the scope of NIS2 must tackle the critical issue of leadership. The new obligations require that management approve and oversee cybersecurity risk management measures. To approve and oversee, leaders must



ABOVE Sir Chris Bonington, who led the first ascent of Everest's southwest face, can teach us all lessons

RIGHT If we can climb the southwest face of Mount Everest, we need not fear infosec

understand cybersecurity risk management measures. That means that where leaders have failed to grapple with the fundamentals of information security, they must undertake training – or, to put it another way, the gap Martin highlighted in his 2018 presentation.

Leadership and teamwork

The importance of leadership cannot be overstated. In Doug Scott's words, Chris Bonington had "honed the art of large expedition planning to perfection". While Bonington was a skilled and accomplished climber, his leadership skills were a key to success. Bonington nurtured skilled climbers, supported group harmony and effectively managed the complexities of high-altitude expeditions.

As part of the team, Tut Braithwaite alongside Nick Estcourt climbed the sheer obstacle at 8,200 metres known as the Rock Band, a feat that has been claimed to be the hardest extreme altitude technical climbing ever undertaken. As they climbed, they put measures in place, setting up fixed ropes that the rest of the team would rely on to make their ascent.

Bonington as the leader didn't go with this part of the team, stand over them or bark orders at them to fix ropes here and there. Nor did he interfere with Braithwaite and Estcourt. As the leader, Bonington selected those on his team for their ability, then he gave them the tools, gear and support as well as the autonomy so that they could simply get on with the job. Leadership is not a synonym for micromanagement.

It is essential that business leaders select individuals with the appropriate and relevant skills and ability. Once this selection is made, it's prudent for the leadership to grant their team the room to manoeuvre independently.

Changes to the legislative landscape mean that businesses can no longer simply rely on input from information security personnel. Getting it right will require team effort. Have a leader with deep technical ability, yes, but make sure that you have access to someone that understands the legal context for these new infosec obligations.

Take the matter of SolarWinds. Criminals compromised SolarWinds' software and embedded malicious code. The successful civil litigation that followed didn't turn on a technical matter. Instead, it was the representations that SolarWinds had implemented best practice that were contained in corporate documents that provided the claimants in the case with their strongest argument.

Stay in your lane

No-one is saying that the information security professionals should also understand all the rules about corporate communications, corporate law and governance. That's why you have people who do understand those factors on your team, or you have access to those experts. Either way, when you have advice from those individuals it behoves the leadership to take their direction on the matters that fall within their areas of expertise.

Years ago I had a great boss; let's call him Dave (since that was his name). Dave was fond of saying you need the right person in the right position. In other words, you don't want your best logistics guy establishing the rope work or your best alpinist on strategy. Know what you do and do what you know. And get on with your job.

Alternatively, there's always the option to go the SolarWinds route. Management blithely ignored their expert who forewarned them of the foreseeable problems that lay ahead. Failing to take reasonable care led directly to civil litigation and a $26 million payout for the claimants. Beyond the possibility of civil litigation, the financial penalties under NIS2 range from €7 million or 2.4% of global annual turnover to €10 million or 4%, whichever is higher. Pick your position and take care, or ignore the warnings and best of British luck with that.

The five Ps

Proper planning prevents poor performance. Careful preparation to manage the risks is key for two reasons. A clearly articulated strategy and plan should be in place so the team as well as the wider business understand what should happen and when. It helps to provide a framework for operating and for understanding when essential milestones have been met.

Scheduling these steps provides much needed transparency, helps to identify delays in advance and allows for prompt corrective actions. Furthermore, having a plan ensures resources are allocated efficiently, minimising waste and maximising productivity.

ABOVE SolarWinds CEO Sudhakar Ramakrishna at the Senate Intelligence Committee hearing in February 2021

"Businesses can no longer simply rely on input from infosec personnel"

Bonington's meticulous planning meant that the equipment and much of the food needed for the expedition left London months before the initiative would begin. Any gaps in essential supplies could be remediated by providing a long run-in time. There's simply no substitute for preparation.

Moreover, Bonington wasn't afraid to use new technology. He relied on a computer to plan his expedition, while others were still committed to pen and paper. This willingness to embrace the tools he needed to get the job done undoubtedly helped with managing the huge number of details required to keep the project on track. It also meant that Bonington and his deputy were able to provide the essential visibility to the financial backers that their resources were being put to good use. You're not scaling Everest, but do what works for you, your team and your business.

Peak performance

The story of this remarkable ascent is not just about the physical achievement but also about the critical role that leadership, teamwork, technology and equipment play in such endeavours. It emphasises how advancements in gear and meticulous planning contribute significantly to success in extreme conditions. In other words, people, tools and processes. The point at which innovation, technology and human perseverance intersect can create extraordinary outcomes.

If half a century ago a team of men could carve out a new route on the highest mountain in the world, then today's businesses can put the right people, tools and processes in place to manage the changing infosec and compliance landscape.

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DAVEY WINDER

“What if someone had got through the iOS defences? What if my iPhone was spying on me?”

Davey responds to Elon Musk and answers the “Am I Secure?” question that, it seems, is worrying so many iPhone users

At this point in time, I’m really not sure if it counts as a flex or the precise opposite, but Elon Musk recently reposted a tweet (twix, tweet, Xeet – I give up) about an article of mine discussing iPhone spyware attacks that had been published at *Forbes*. Needless to say, that got me a lot of attention, both positive and negative, from the Elon followers as well as the looney tunes conspiracy brigade. There’s some overlap between the two, but that’s beside the point.

The point, dear reader, is that the overwhelming majority of those emails and direct messages on X were asking about the best way to detect spyware on your iPhone and how such detection works. Oh, and with a nod in the direction of the looney tunes folk, how safe this is, what with “The Man” watching all we do and collecting data using so-called protections to infect us. Sigh.

Anyway, I thought I’d take a bit of a deep dive into the subject through the lens of a rather interesting app called, aptly enough, Am I Secure?.

How it all started

There I was reading about Apple’s threat notification system that warns high-risk iPhone users of spyware attacks against them. You’ve probably never heard of these, let alone seen one, as Apple admits it hasn’t sent a load of them. In an October 2024 support posting (**tinyurl.com/366apple**), Apple said: “Since 2021, we have sent Apple threat notifications multiple times a year as we have detected these attacks, and to date we have notified users in over 150 countries in total.”

I’m enrolled in the Google Advanced Protection Program as – although I do find it highly amusing – I’m considered to be at high risk of attack. That program keeps my Google accounts pretty safe. When it comes to iOS, of which I have two active phones, a huge iPhone 16 Pro Max and a diminutive iPhone 13 mini, so sue me, I’m aware of the threat but have never really worried too much about falling victim when it comes to spyware. Until I started reading about these notifications: paranoia much?

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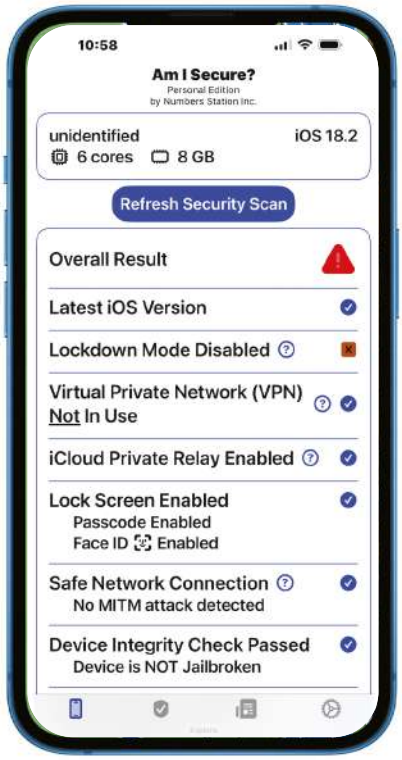
@happygeek

“I’ve never really worried too much about falling victim when it comes to spyware”

In case you’re wondering what such a notification looks like, the wording is thus: “Apple detected that you are being targeted by a mercenary spyware attack that is trying to remotely compromise the iPhone associated with your Apple Account. This attack is likely targeting you specifically because of who you are or what you do. Although it’s never possible to achieve absolute certainty when detecting such attacks, Apple has high confidence in this warning – please take it seriously.”



RIGHT The free app security check is pretty decent in itself

Where it went next

So, I took it seriously even though nobody had targeted me successfully, as far as I knew. And there’s the issue – as far as I knew. I mean, I’m not stupid, and I readily admit that Apple is right when it says that the kind of spyware attacks it’s talking about are vastly more complex than most consumer-facing malware. I agree that this kind of mercenary, and almost always nation-state-sponsored attacker, will have the kind of resources not available to most criminals to target a very small number of iPhone users.

Apple said that the people so targeted will have been “likely because of who they are or what they do”. Agreed, agreed, agreed. But what if someone had got through the iOS defences and my own safeguards as a security pro? What if my iPhone was spying on me? What could I do to find out? And so, my journey to find a solution began. Here’s how that went.

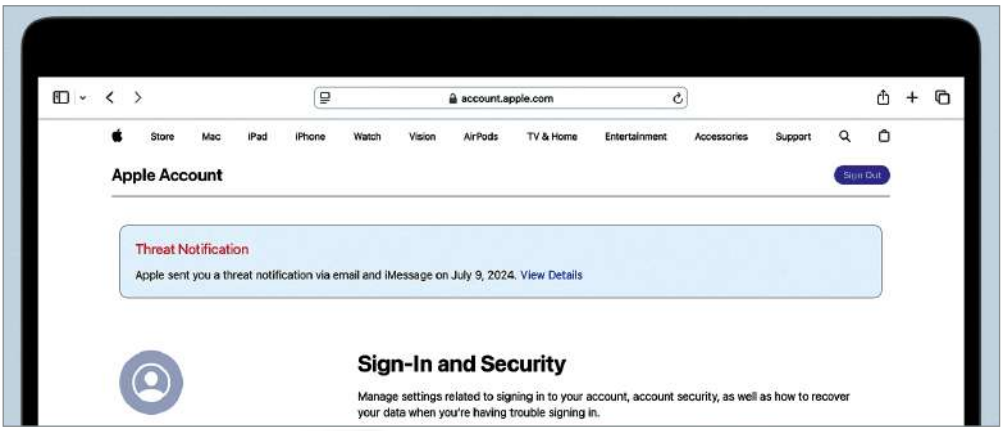
There are, it turns out, no shortage of apps and services claiming to protect your iPhone from spyware attacks. As I soon discovered by doing a bit of donkey work, however, many of the apps claiming to protect you from nation-state spyware attacks are actually just confirming what you already know, or rather, what you should already be doing to protect yourself.

What do I mean by this? Simple: iOS sandboxing is a great security and privacy feature that also happens to mean that the data needed to be accessed to perform a meaningful security analysis of your device isn’t available to these apps. Instead, from what I can tell, most tend to focus on things such as security policy compliance, or look for a lock screen passcode being enabled, or check to see if the device is jailbroken and running the latest version of iOS.

Pass all these checks, and guess what? Not only is your iPhone still vulnerable to the most advanced of spyware attacks, but it could even have already fallen victim to one.

I asked: Am I Secure?

During a social media discussion of the risks of spyware on an iOS device, someone reached out with information regarding a possible solution that could do all the things I’d been thinking about. That someone was Colin Caird, founder of Numbers Station (**numbersstation.app**).



ABOVE **Apple's threat notification system warns iPhone users of spyware attacks**

LEFT **The advanced scan is where the real value of the Am I Secure? app lies**

Ordinarily, I ignore such messages as they're usually a sales pitch for some stale and pointless money-grabber. However, there was something about the language Caird used, something about the tech he mentioned, that got me intrigued enough to investigate further.

That thing I investigated: an app called Am I Secure?. I quite like the "what it says on the tin" approach to apps, so Caird was already off to a good start. Before I went any further, though, I dug into the background of the app itself: anything that wants to probe my device and data needs to be probed by me first. I think it's called due diligence and appears to be something overlooked by far too many folks, including those who really should know better these days. I trust you're taking notes, dear reader, although I'm sure that wouldn't apply to the *PC Pro* massive.

It turns out that Caird has been providing security solutions to government clients by way of a standalone on-premises version of the Am I Secure? app for some time. Which is a good thing. Obviously, pinning down in print exactly which governments is tricky, but I can confirm it includes multiple NATO governments with cabinet officials, heads of state and prime ministers in that number. For once, you'll just have to trust me on this one.

"Our government clients have already discovered active operations against their devices running the latest versions of iOS," Caird told me, although, once again, you'll have to trust me in verifying this as the data is highly confidential. The consumer version of the app is, I'm happy to report, both relatively simple to use – and more of that in a moment – and efficient at what it does – more of that as well. But first, the science bit.

Searching for spyware

The free version of the app does much of the bog-standard "security" stuff that other such apps do. Think checking for iOS version, whether iCloud private relay is enabled or not, looking for man-in-the-middle attack indicators, third-party keyboard risk and so on. But it's the advanced security scan for malware and spyware that I'm interested in.

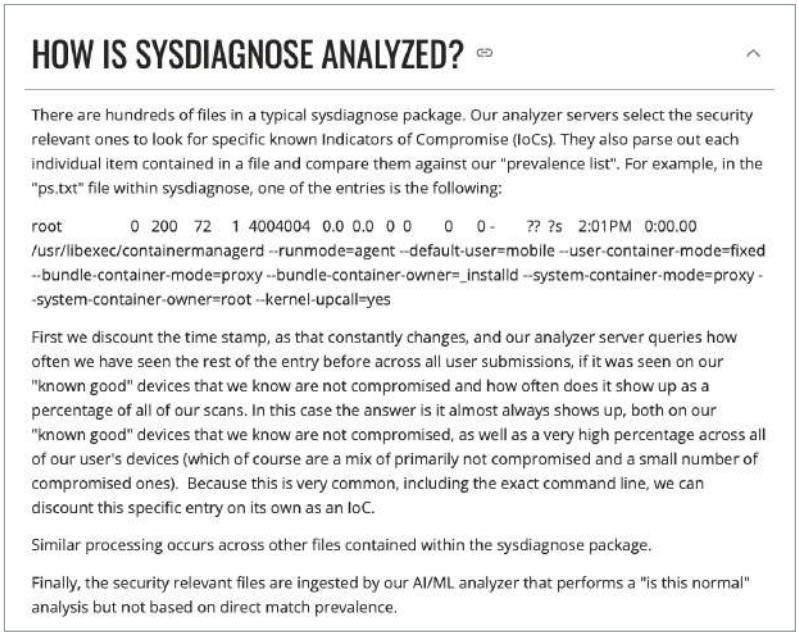
This isn't free, however, and the subscription can be a monthly £9.99 (if you just wanted to do a one-off check, for example), or yearly at £50 which, at just a tad over £4 a month, seems reasonable for peace of mind if you're worried that your data could be at risk from spyware threats. The advanced scan costs money because it takes resources, including a team of cyber-threat analysts specialising in the mobile sector. It will manually review any and all anomalies discovered during a scan to determine if your iPhone has been compromised or not.

"It will review any anomalies to determine if your iPhone has been compromised"

So, how does it work to get that data in the first place? This is where things get interesting, as the advanced scan requires access to your system diagnostic report, which you'll need to initiate first. This collects, as you are likely aware, data about iOS and running processes. Red flags, alarm bells, whoop whoop, that's the sound of the place. But fear not; this data is end-to-end encrypted on your iPhone, and only the Numbers Station analyser server can decrypt it.

If you want to know the entire process, for transparency, which is always to be applauded for such services, here goes. The encrypted file is first sent to Firebase Cloud Storage in the US (Oregon) but cannot be read, from where it is downloaded to Numbers Station servers for local decryption and analysis. The results are sent back to Firebase's Firestore database where the app pulls them and displays the results to the user. Those analyser servers are Mac minis, physically located in Canada and where the decryption keys reside.

"Your sysdiagnose data is always stored in an encrypted state when in cloud storage so it is unreadable by anyone accessing it other than Numbers Station Inc," Caird told me. "Our analyser servers are only permitted to connect to Firebase and Apple (for macOS updates), have



HOW IS SYSDIAGNOSE ANALYZED?

There are hundreds of files in a typical sysdiagnose package. Our analyzer servers select the security relevant ones to look for specific known Indicators of Compromise (IoCs). They also parse out each individual item contained in a file and compare them against our "prevalence list". For example, in the "ps.txt" file within sysdiagnose, one of the entries is the following:

root 0 200 72 1 4004004 0.0 0.0 0 0 0 0 - ?? ?s 2:01PM 0:00.00 /usr/libexec/containermanagerd --runmode=agent --default-user=mobile --user-container-mode=fixed --bundle-container-mode=proxy --bundle-container-owner=_installd --system-container-mode=proxy --system-container-owner=root --kernel-upcall=yes

First we discount the time stamp, as that constantly changes, and our analyzer server queries how often we have seen the rest of the entry before across all user submissions, if it was seen on our "known good" devices that we know are not compromised and how often does it show up as a percentage of all of our scans. In this case the answer is it almost always shows up, both on our "known good" devices that we know are not compromised, as well as a very high percentage across all of our user's devices (which of course are a mix of primarily not compromised and a small number of compromised ones). Because this is very common, including the exact command line, we can discount this specific entry on its own as an IoC.

Similar processing occurs across other files contained within the sysdiagnose package.

Finally, the security relevant files are ingested by our AI/ML analyzer that performs a "is this normal" analysis but not based on direct match prevalence.

LEFT **How Am I Secure? analyses the iOS sysdiagnose file**

Continued from previous page

iMessage disabled and are not used for any other purpose, making their exploitation high unlikely."

Those servers look for indicators of compromise and anomalies in the diagnostic information that deviate from a known good or expected baseline so they can be triaged for manual analysis. "As new threats and related IOCs are found," Caird said, "old submissions (which are retained for up to three months) are re-analysed, with any changed results sent to users."

Using the app: how easy is it?

The app isn't the most straightforward to use as it requires the user to go and get that iPhone system diagnostic report and upload it. This won't be beyond the ken of any *PC Pro* reader, but there is a literal shortcut you can take to make it less of a pain. If you think that clicking through Settings | Privacy & Security | Analytics & Improvements | Analytics Data is a pain, that is. Anyway, I've set up a shortcut for the process using the accessibility options, and you can do the same by heading to **tinyurl.com/366shortcut**.

Caird told me that the Am I Secure? app can detect nation-state-level implants and spyware, including NSO Group Pegasus, which continues to make so many headlines around the world, and provides "the same level of detection capabilities as our government clients".

Importantly, the app doesn't require access to such things as your camera, contacts or microphone. Why would it? Something you should ask yourself when it comes to some other apps claiming to offer protection.

Numbers Station suggests the same approach as Apple when it comes to what to do if you discover you've been compromised. Rather than offering to intervene on your behalf, it links the victim to a relevant third-party organisation. "We recommend users that have a compromise and work in media or human rights contact Access Now, Amnesty Tech or Citizen Lab to perform the forensic work required to determine the vulnerabilities that were exploited," Caird said.

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STEVE CASSIDY

"The Russians have rediscovered the art of dragging the seabed for cables and cutting them"

The recent assaults on undersea cables that make the internet work open up questions about businesses' reliance on faraway servers

The most important book in my modest collection of tech literature is pictured opposite. *How the World Was One* is a dreadful pun of a title, by scientist, wartime boffin and sci-fi author Arthur C Clarke. It's his account of how several generations of communications engineers connected together the world's political classes, by way of telegraph Morse code, telephony voice signals and eventually the internet.

What has this to do with 2025? Because the Russians seem to have rediscovered the fine art of dragging the seabed for submarine cables and cutting them. A sufficient number of those cables carry regular, public internet traffic to make this wholly relevant to 2025. And, more pointedly, to make your cloud resources and your backup/restore technology truly location independent.

I will, now and then, refer to Clarke's account of modern infrastructure construction and repair despite the fact the book has been out of print for a few decades. Its age should not be taken as an indicator of its irrelevance or the quality of research presented. When I bought my copy, the world's long-haul data transmission experts were scouring the world's second-hand bookstores for copies too, not just because of the unique disclosures from one of the inventors of Radar and the geosynchronous satellite, but because the secrets of cable-laying and cutting don't change much through the centuries. Right from dit-daah-dit of Morse code through the 5-bit binary of Telex signals and up to date with multi-waveform single mode fibre "cables", the procedures and accompanying challenges remain much the same.

Clarke details the drama and determination that gave us the first transatlantic cable, managed by Brunel and delivered by his game-changing iron-hulled steamship, the Great Eastern. It took more than one attempt to lay a cable from Ireland to

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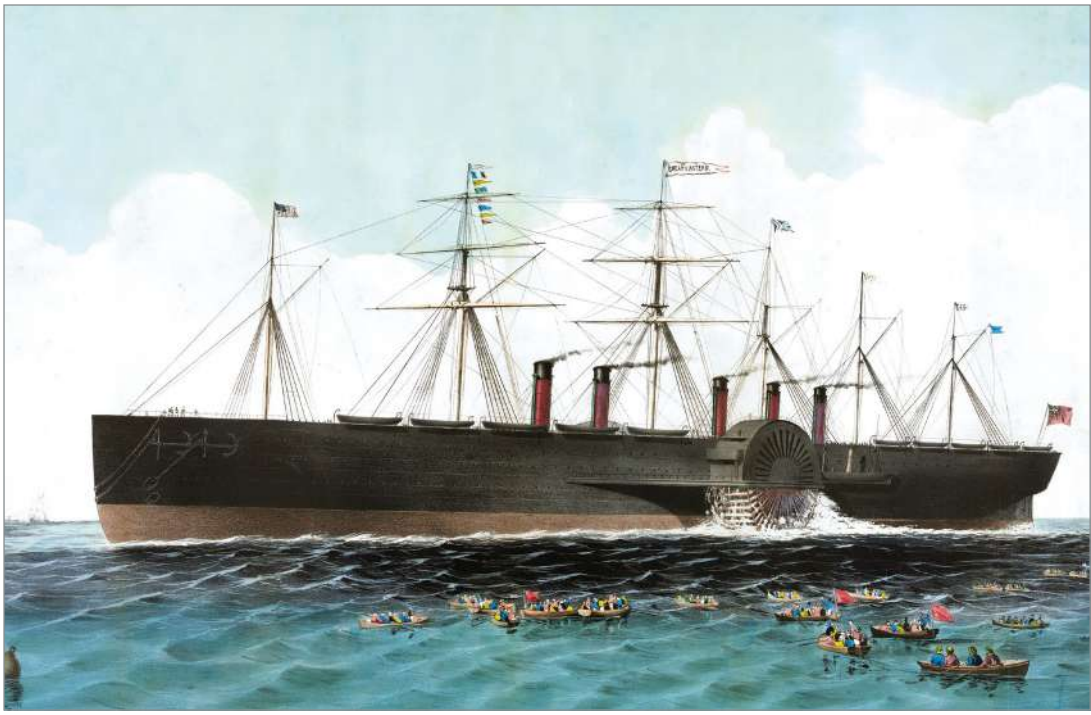


BELOW Artist Charles Parsons' depiction of Brunel's Great Eastern from 1858

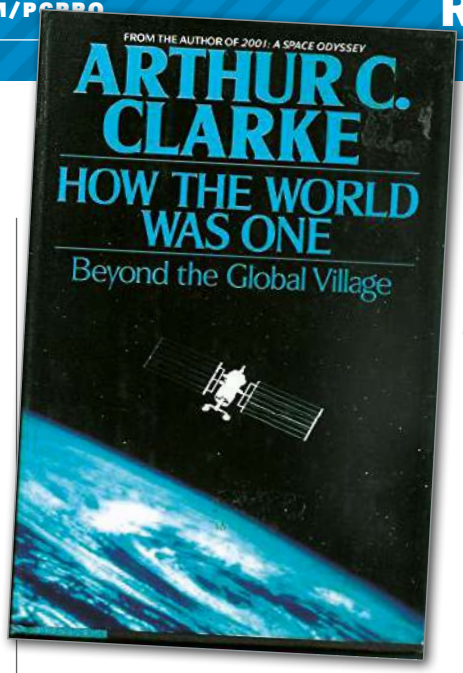
Newfoundland, and when I say "attempt", I mean that the company formed to pay for the making of the cable and the coal in the bunkers of the ship went explosively and painfully bankrupt when the first attempt didn't deliver a working cable. Some of these difficulties were down to arcane matters such as signal degradation over thousands of miles; others were things like giant squid or sperm whales chewing on the cable in the darkling abyss. Clarke explains that the cable design and preferred signal format evolved together, quite expensively, mostly as a burden on the British economy.

I can't postpone the punchline here any longer. While Clarke doesn't ponder this matter directly in the book, he points to a very simple fact. The very first cable-layers did at least as much cable recovery and repair as they did laying. The equipment necessary to find and haul up a heavy communications cable from thousands of feet deep in the ocean was readily available even on the Great Eastern; a revolutionary vessel to be sure, but one that still had some masts and sails, just in case.

So, when you see an article making a fuss about some mysterious agency slicing cables in strategic locations, don't get caught up in the panic. Think about the benefit secured by the mysterious attacker, and the likely time-to-repair; in the case of a shallow location such as the Baltic, most of the repair delay will be the travel time of the repair ship to the location of the break.

This presumes that detecting the exact spot in a featureless ocean for a repair craft to aim itself at is even possible, but here at least there have been improvements since Brunel's time. Even back then, measuring the electrical characteristics of a cut cable gave a fair guess as to where it had been cut. In fact, if you've ever played around with some of Intel's Ethernet diagnostics, you'll have seen neat little modern-day implementations of a measurement first put to practical use back in the time of horses and highwaymen.

Modern fibre-based cables aren't as inherently helpful as an old school lump of copper wire, but the various speed and capacity improvement hacks in the overall cable design make this difference in materials into an advantage, not a hindrance. Fibres have booster stations at regular intervals in the cable; these are, incredibly, battery powered, and function as a repeater. Their design is dependent on being regularly hauled up out of the depths for a battery swap, and a repair recovery is simple for such technologies.



LEFT **Arthur C Clarke's *How the World Was One* is a history of global communications**

The important takeaway here is that the fault-tolerant design for your company's assets – which discover they have been cut off from each other by an assumed cable break – doesn't have to be eternal. Repairs will still take a few weeks, but this means temporary fixes to make isolated affected systems work from localised replicas are more tolerable. After all, the cloud wouldn't be workable at all were it not for the ability to replicate data between lumps of storage.

Business workloads

I realise that while discussing tolerance against undersea cable attacks, I have so far talked about business workloads that are, at heart, internal facing. But we also need to mention websites.

That's because resolving even a mild traffic bottleneck to a website is one of the great problems of the past few years. Can't get in the way of the money, you see. We're used to the term CMS for content management system, but these should strictly be renamed DCCMS – big hosts replicate your site files between invisible data centres so that customers in poorly connected countries are directed to physically nearby replica servers. The international links simply move the master copy data (and VMs, these days).

We're not allowed to poke our noses under the covers at the big cloud providers, but it's fair to assume that most of those have outpost data centres scattered around in places where bad temper or despotism turn global data into a bit of a pipe dream for the locals.

"Where the trouble sets in is in the burgeoning SaaS markets"

Where the trouble sets in is in the burgeoning software-as-a-service (SaaS) markets. Many of the big names insert their added value in front of your deployment, and you aren't meant to ask questions about where their servers are physically located. For a refreshingly transparent declaration of the deployment of cloud SaaS, take a look at the Cloudflare Architecture Reference resource (**tinyurl.com/366cloudflare**). Cloudflare mentions that it passes most of the world's internet traffic, which probably means it too is running its own massively distributed system design – but that's not automatically so for other providers.

An awful lot of "white box" companies set up a front-of-house in the country they want to sell to, while actually adding their compute power back home, because they cut an economy-of-scale deal with the data centre round the corner (or sometimes, because their insurers won't let them operate on foreign-soil hardware). The lesson for you? Make sure you aren't being overconfident about system resilience if you use such a provider. It's one thing to confidently tell the board – and your customer base – that you can survive foreseeable enemy action, and another thing when it happens and you realise you were at jeopardy the whole time.

ABOVE **Cloudflare claims that it passes most of the world's internet traffic**

That goes double for single-purpose SaaS brands. Just think how you might get round not being able to take payments via your chosen provider, for instance. Likewise, there's not much point in having a war chest of cryptocurrency squirrelled away in a repository that turns out to be

Image: Courtesy of Wikimedia Commons

on the other side of a subsea cable link that suddenly stops working.

Funnily enough, the most prominent country thinking about these risks turns out to be Russia. It war-gamed a scenario in which it was completely cut off from the rest of the planet as far as the internet was concerned. While we might not agree with Russia's aims or intentions, you can't fault its capacity for intellectual analysis. A willingness to look into the worst-case scenario is something we would do well to emulate.

Letters from the Edge

There was only one Christmas present I was hoping for in 2024. Despite some satisfactory trailing-edge purchases after the recent near-collapse of Intel (a 13in MacBook Air for £150? Don't mind if I do!), I wanted the Raspberry Pi 500 (*see issue 365, p54*).

This is the Raspberry Pi 5 variant of its cute little "machine in a keyboard" design. I already have a Pi 4 in a keyboard; all I can find to criticise about this is the relatively unsophisticated GUI when compared to equally cheap Apples or rapidly depreciating Intel-based Windows 11 machines.

But what really piqued my interest is that the Pi 5 has add-on boards that let you directly connect NVMe storage (what a missed opportunity that the Pi 500 doesn't have an M.2 slot). I know you can boot from an SSD via the USB drive on a Pi 4 platform, but my focus here isn't the chunk of the Pi world that's held together with elastic bands and chewing gum. I'm thinking about users who only react favourably to devices that look like finished, professional, comforting bits of design.

And I want these devices in front of users. A keyboard-mounted Pi fits in a Jiffy bag and can be updated by sending out a microSD memory card. It would be hard to come up with a more convenient device for working-from-home support, and that's before contemplating the difference in cost. A Raspberry Pi 500 comes in at around £180 with various little extras, which means you can have eight or ten of those for the cost of a new, corporate-grade laptop.

When unreliability made replicas

Back in the 1990s I had a lot of fun building global email systems. These straddled the eras of old-school phone calls by modems to widespread take-up of internet connections. We actually created a complete network linking over 50 subsidiaries around the world back to the head office in the UK, solely by using top-end modems and software. The latter handled the schedule of calling the rack of devices back in the office, and the list of files and emails that needed to be copied across the wire.

This was, I must say, phenomenally reliable. Later on, a couple of similar distributed networks were built in advance of higher-speed connections as the internet grew both in population and performance, using the rather more sophisticated and ornate services provided by Lotus Notes.

I can hear some old nerds out there hissing through their teeth at this mention, but I refuse to join in with the critical litany that sought to usurp Notes for Microsoft Exchange. The two products did completely different jobs for completely different business roles and purposes.

Notes' stand-out capability for me was its dogged and apparently indefatigable approach to data replication. One trial required data replication between a tribal medical centre in southern Malawi, a US air base in Afghanistan and a resort town near the Black Sea in Romania. We burnt CDs containing only header data and security templates for files that had been seeded on the Notes server farm in head office, deep in exotic and war-torn South London.

Some of those CDs were, at various points in their delivery journeys, carried in backpacks before being posted to windswept, rusty metal pick-up postboxes in the foothills of the Himalayas; the diametric opposite of what happened once they were deposited on the arrays of the servers already running in each location. The replication process started them filling up, quickly for some and more slowly where the analogue modem still held sway.

This stuff really worked. The guy who designed a lot of those features subsequently went on to be the principal architect of Microsoft Azure, which has de-emphasised replication as part of the basic product feature list, leaving it as an optional add-on available from a variety of suppliers. Once in full 1990s nostalgia mode, I'm inclined to wonder whether cloud architectures are actually a leap forward when the times become more violent and uncertain. We had it good back then.

ABOVE All I wanted for Christmas was... a Raspberry Pi 500

What really kicks off with the NVMe options on the Pi 5 is the idea that you can present home users with a full local replica of your entire company data set. Okay, so the logic about cheapness starts to weaken here, because 4TB of NVMe storage will add a few hundred quid to the price.

But that's where replicas come on. Board members' WFH config can be full copies, but the accounts team need only the accounts data, stock control only their fulfilment and invoicing, and so on. You only have to make two or three different replication content profiles for the benefit of this approach to start accumulating.

If you were to go to a big systems integration or reseller business and start talking about this as a design option, they would of course be quite keen to plump it up to the same expense bracket as the old-school hardware purchasing budget, or come up with various show-stopping reasons why you couldn't do this. My argument: with the gradual demise of Windows/Intel architectures, they have no safe option to present you with. The "traditional solution" is no longer compelling because everything is up for re-evaluation.

"The most important thing to re-evaluate is the whole idea of edge computing"

I believe the most important thing to re-evaluate is the whole idea of edge computing. Time was that everything had to be cloudified, because the effort of washing all that data around a distributed workforce was simply too high. The edge was a place where data was generated and collected, with servers bristling with their own Wi-Fi antennas in order to listen to all those network-equipped nano-devices recording half a dozen environmental statistics – or just the same picture of the back of your car park – every few seconds until the heat-death of the universe.

I think the edge is now much more important than that, with releases of platforms such as the Pi 5 opening up a tectonic shift of roles. I'm talking about a move away from the cloud and towards local smarts, now both big and fast enough to be handling jobs long thought of as "rack only".

I hope that the peace and quiet interval of lockdown is bringing forth a lot of desirable software releases in the Linux continuum, too, though the Linux sense of "oh, that was solved in 1972" could do with a slap round the chops. Where's my friendly, background data replication peer-to-peer platform to make best use of 50 Pi 5 computers loaded with 4TB of NVMe each, keeping my company data safe with a mesh of 50 replicas? Come on, chaps, there's work to be done here.

cassidy@well.com

BELOW **The ZX Spectrum Next is a modern update to the ZX Spectrum**

Old computers, new tasks

Classic computers can remain relevant in today's world thanks to modern hardware and software, as David Crookes discovers

An intriguing photograph recently appeared in my Facebook feed, featuring an employee at a US doughnut shop using one of two Commodore 64s to process orders. The post featured the ageing computers positioned side by side in Hilligoss Bakery in Brownsburg, Indiana, and it garnered more than 1,300 comments, many of which echoed the old adage, "if it ain't broke, doughnut fix it!"

Upon closer examination, it became evident that the computers were running a program written in BASIC, a relatively primitive programming language by today's standards. But, as one poster asked, "how much computing power do you really need to sell doughnuts?" The vast comments thread also highlighted the continued use of Commodore 64s in various other contemporary settings.

There are reportedly instances of Commodore 64s being used in a US automotive repair shop and by an engraver. Nor are examples of retro computers in modern settings limited to the C64. DOS machines are being used to run a dry cleaners in Austin, Texas, while a Sinclair QL operates a greenhouse irrigation system in Romania. There are likely countless other examples, but are there truly any tangible benefits in preserving and using such outdated systems?

In many cases, using ancient machines to perform tasks in the modern day isn't a deliberate choice. It's more a matter of we've started, so we'll continue.

Hilligoss Bakery has been around since 1974, and it probably began using the C64s shortly after their release in 1982 and simply continued with them. Similarly, the US military's DEC PDP-11s were used for decades, while NASA software from the 1960s and 1970s persisted into the 2000s.

But there are advantages of using decades-old machines beyond inertia. For instance, they can be incredibly reliable and they don't require constant updates. Grab a computer from the 8-bit era and you can be almost certain that it won't be susceptible to viruses, either.

Retro machines are also great for storing private information such as passwords and financial details. Since files designed for retro computers can't always be executed on modern systems without emulation, there's a natural barrier.

To that end, using a less powerful and stable machine can be advantageous if the tasks are relatively straightforward. If all you require is a word processor, simple spreadsheet or basic inventory tool, for example, there's ample software available from many years ago that can perform these tasks effectively. As long as the floppy disks or tapes haven't degraded, you should be able to get up and running very quickly.

Old meets new

But what if you want to revive a vintage computer and incorporate it into your personal or business workflow? It's all well and good grabbing an old copy of a word processor from eBay, rattling off a bunch of files and saving them to disk if you're entirely happy for that work to remain in isolation. If, however, you want to share it with other people or continue working on a modern machine, then you may find yourself in a bit of a pickle. How will you transfer those files from the old computer to the new?

Over the years, hobbyist communities have emerged around many retro computers, and enthusiasts have resolved this very issue by writing apps and

BELOW **Amstrad CPC users have connected their PCs to Wi-Fi using the M4 Board**

developing hardware that make older machines more relevant to users in the modern era. You can now connect retro computers to modern monitors and use expanded memory, Wi-Fi connections and more reliable SD cards or hard drives. You can also use operating systems that replace command prompt interfaces with Windows-like GUIs and take advantage of more recently created software that lets you save files in a format that modern computers can recognise.

To achieve this higher level of integration, however, you will need to splash some cash. In some cases, you may also need to become more involved in your chosen retro computer's community by signing up to forums, joining Facebook groups and following the right people on social media.

That's because you'll require extra hardware – peripherals that aren't always readily available. In many instances, you're relying on a sole guy operating from a back bedroom to make a device from scratch while simultaneously managing all the responsibilities of life including family, work and friends.

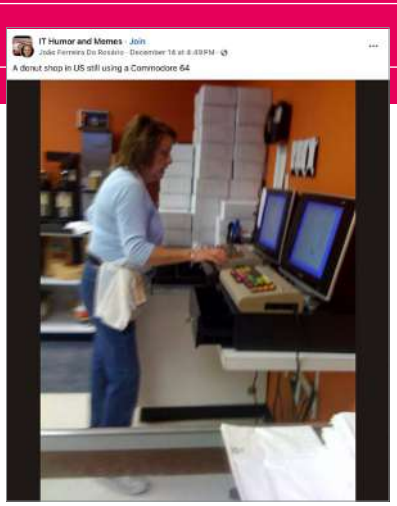
The good news? Most of these community groups provide information about availability, waiting lists and alternative products and they are, for the most part, friendly and welcoming.

Hardware revival

Community forums can also provide technical support that can be invaluable if you're looking to perform professional tasks that were often a pipe dream when the computers were in their heyday. At the very least, you may need some guidance on which wires to buy. Thankfully, companies such as **coolnovelties.co.uk** are very helpful.

They can assist you in finding the necessary video cables to connect a wide range of retro computers to many different displays, eliminating the need to rely on increasingly rare and expensive CRT TVs or monitors. You're also likely to come across newer power supplies that should prove safer than the aging originals.

Beyond that, however, the types of available products will depend on the computer you're trying to modernise. If you want to tinker with an Amstrad CPC 464 or 6128, for instance, you could consider connecting them to Wi-Fi using the popular M4 Board expansion card. This allows you to use a web browser on a PC or Mac to drag and drop CPC files and programs onto the peripheral's SD card and make direct use of them on Amstrad's 8-bit machine.



LEFT This blurry image shows C64s being used in a US bakery

BELOW SymbOS – here running on an MSX computer – has lots of modern software available

The deeper you explore each computer's community, the more you'll discover

This eliminates the need for floppy disks or tapes, and it also allows you to download programs from the web for use on the CPC. You'll gain access to more recently developed applications that were never released on tape or disk. Furthermore, if you also acquire expanded memory (enthusiast-created expansion packs for the CPC can offer up to 4MB of RAM), you'll be well on your way to creating a truly powerful machine.

The CPC 6128 also lets you connect ROM boards and have key software such as the acclaimed 8-bit word processor Protext on instantly loading ROMs. Additionally, you can connect an internal Gotek drive, a modern disk emulator that replaces traditional floppy disk drives. This enables you to save programs on USB flash drives and locate files by pressing buttons or turning a rotary dial until its name appears on the unit's built-in display.

Gotek drives are also available for the ZX Spectrum +3, Commodore Amiga, Atari ST and other retro computers. Since they lack moving parts, they've proven to be highly reliable. You can save files onto the USB flash drive and use them on your PC or Mac, making file transferring a breeze. Suddenly, you're transforming a retro computer from a dusty relic into a functional device.

But there's more. The Spectrum also has SD card-based storage solutions (such as the divMMC Future) along with the Specranet Ethernet interface and memory expansions. The Commodore 64 has RAM expansion units, accelerators and mass storage devices including SD2IEC, which replaces the Commodore 1541 disk drive.

The Amiga is blessed with FPGA-based and Raspberry Pi-based accelerators, and you can buy the recently released Indivision ECS V4, a frame rate converter that eliminates flicker on VGA monitors, flat screens and large televisions. Additionally, Plipbox allows you to connect Amigas to the local network via Ethernet while RapidRoad provides USB ports.

Modern adaptations

The deeper you explore each computer's community, the more you'll discover the remarkable advancements achieved by machines from the past. You'll also find numerous serious software applications that bridge the gap between older and newer computers.

Applications are still being developed for the CP/M operating system, which has been around since 1974. As an example, 2024 saw the release of the On File database management system inspired by the PC applications of the MS-DOS era. There's also a great cost-monitoring system called COSMOS that allows users to edit their daily income and monthly expenses and perform trial and error analyses.

However, many serious applications are being created for retro computer operating systems that weren't even around a couple of decades ago. In the case of 8-bit computers, some of the most exciting developments revolve around the multitasking SymbOS initially released by Jörn Mika. It can be installed for free on a mass storage device such as an SD card.

"SymbOS has a full-featured Windows GUI with all kinds of elements," Mika told *PC Pro*. "It also

Images: Spinpoint.org/CPCWiki, SymbOS, ZX Spectrum Next, Simulant, SymCalc

has true pre-emptive multitasking on an original 4MHz Z80, usually without any performance losses – you can run a music player, download and unzip a program and chat with your friends online, all at the same time."

SymbOS provides flexible memory management with support for up to 1MB of RAM, dividing the RAM into 256-byte pages and using the memory with maximum efficiency. But what makes it more interesting is its compatibility with many different platforms including the Amstrad CPC 6128, Amstrad PCW, MSX2 and Enterprise 128 with floppy disk drive.

"In 2024, we added support for the ZX Spectrum Next, Amstrad NC100/200 and SymbOSVM ports, the latter letting you run SymbOS in a near-native way on a Raspberry Pi or x86 machine," Mika said. With more than 60 SymbOS applications and games as well as tools and libraries for the development of your own applications in languages such as Quigs IDE and SymbOS C Compiler, there's a lot to get your teeth into.

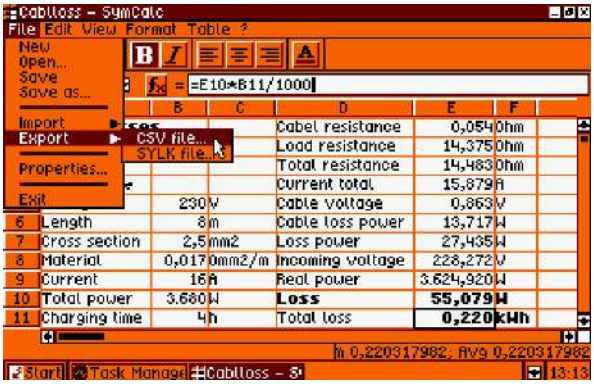
For starters, you can launch the Notepad text editor to create and edit plain text documents, launch the standard and scientific Pocket Calculator and make use of SymbOS E-Mail, a Win9x-like email client that features an address book and lets you send and receive attachments.

The year 2024 also brought SymCalc, a fully featured spreadsheet app that aims to bring the delights of Excel to machines running SymbOS. It includes more than 50 functions, absolute and relative cell references and fast auto-recalculation of cells. You can even import and export CSV and SYLK files.

"I wanted to show that large and powerful applications, which have even more functionalities compared to those from the 1980s, are possible in SymbOS," said Mika. "I'd always dreamed of programming a GUI-based spreadsheet application like Excel because I was always fascinated by those cell calculation algorithms, formulas and all that stuff. Now I want it to be the first part of a new office suite and a word processor is coming next, perhaps over the next year or two."

SymbOS also has file and disk management programs, a font editor and, in the past year, Star Chart. The latter lets users plot the sky with stars and planets for any time and geolocation. You can even use CPvM and run multiple CP/M virtual machines in SymbOS. "This lets you execute several business apps from the 1980s at the same time so long as they were made for the old CP/M operating system," Mika added.

You could go retro without really going retro. Lots of old software has been updated for use on modern machines



Classic code

Other notable operating systems that keep retro computers ahead of the curve include Contiki, available for the Apple II, Atari ST, Commodore 64, Commodore PET, Oric and more. It comes with a lightweight text-based web browser, a basic email program and an FTP client. Meanwhile, AmigaOS 4 fully updates the classic Amiga OS, although you'll need to run it on a computer with a PowerPC processor, which isn't quite in the spirit of running modern apps on a classic machine.

That said, you can ditch the classic DPaint in favour of Personal Paint on the Amiga – there are versions for classic systems – or surf the web using iBrowse. You can scour **Aminet.net**, where new apps are being dropped on a monthly basis. It shows that you don't always need to use a new operating system to enjoy modern applications on a retro machine.

TOP Inexpensive Gotek drives work with many retro computers

ABOVE Created in 2024, SymCalc is a fully featured spreadsheet

BELOW Modern peripherals and new software can help bridge the gap between retro and modern computers

At the very least you'll find many devices and programs that will transfer files from one machine to another. OmniFlop, for example, can read and write multiple disk formats if you have a PC with a floppy disk controller. SamDisk, for Windows, Linux and macOS, can transfer disk images to and from a SAM Coupé and a modern computer, and you could also consider emulation – use your retro computer as intended, transfer the files, and use them within an emulator on your PC or Mac.

You could even go retro without really going retro. Lots of old software such as WordPerfect, Protext and Lotus 1-2-3 has been updated for use on modern machines. If you really want to go far back, consider WordStar, a word processor from 1978. It was reborn in 2023 as an open-source clone called WordTsar, developed by Gerald Brandt, who has used it to write science fiction novels.

"I missed the simplicity of WordStar and hated the complexity and bugginess of modern word processors," he told *PC Pro*. "I wanted to go back to the simple display and keystroke commands I remembered, and there was nothing out there that did what I wanted so I wrote my own."

WordTsar has been updated for modern use so it has partial support for DOCX and RFT documents as well as WordStar 4 and WordStar 7 files. "WordTsar uses the abilities of modern processors and operating systems to reformat the entire document without stopping the user from continuing their work," Brandt says of one improvement.

This means that, regardless of your approach, you can still draw inspiration from the past. You can either seek to use more modern software on old machines or bridge the gap by using retro software on new machines. Either way, you'll be able to keep one foot in the past while moving forward. And have a bit of fun in the process. ●

Futures

Live in the future now

You can have a driverless car, metaverse workplace and home-cleaning robots today! But it will cost you and likely disappoint, says Nicole Kobie

The future is unevenly distributed. That famous axiom, courtesy of sci-fi author William Gibson, has become a tech cliché, but when it comes to the arrival of futuristic technologies it holds true. Yes, many sci-fi innovations are already here if you're willing to put in some effort and turn on your imagination, but you must also lower your expectations.

Consider driverless cars, AI personal assistants and robot butlers. These technologies loom over the horizon. They may never come to be, perhaps tripped up by technical limitations or regulatory demands. But you can try out the early versions of these ideas now for a small taste of what the future could bring.

Here's how to capture a glimpse of the future by renting a swish car, automating your work with AI, upgrading your Zoom calls, working less, and spending far too much money on home appliances.

Hit the road in a driverless car

Dream of sitting back and letting the car do the driving? There are a few ways you can achieve this now. The first is to book an Uber and pretend the driver isn't there – but don't do this. It's rude and it will likely hurt your rider rating. No-one wants to slip below four stars, after all.

The second route is to head to the US or China for a holiday. Pick a destination such as San Francisco or Beijing that has robotaxis operating, download the requisite app, and enjoy geographical and temporal tourism at the same time.

For a ride in a Waymo, you can also head to Los Angeles or Phoenix, and the company plans to expand to Austin, Atlanta and Miami next. Rides are limited to specific catchment areas, however, so you'll have to plan your trip carefully.

Not keen on international travel? You can visit the future of driving while staying home. Level 2 driverless cars are approved on British motorways, so buy or rent the right vehicle and you too can feel the thrill of the future of automotive automation: carefully changing lanes, maintaining a safe distance from the car ahead and dutifully obeying speed limits.

So far, just one driverless system has been approved: Ford's BlueCruise, which is available on the Mustang Mach-E. If you're purchasing the electric version of the classic Ford car, it comes with BlueCruise free for 90 days, and then costs £18 a month – that's right, the future comes with a subscription. Alternatively, hire a Mustang; Hertz offers the vehicle with BlueCruise enabled. Teslas with so-called "Full Self Driving" are also expected to be approved for use in the UK in early 2025.

But manage your expectations. BlueCruise only works on motorways, and the driver must be watching the road at all times, though their hands can be removed from the steering wheel. Indeed, that's the main way that driverless differs from other advanced safety systems in newer cars, which can also watch for lane markings, brake in an emergency and feature adaptive cruise control.

Indeed, the only appreciable differences between driverless level 2 cars and existing automation-based safety features are the technologies that power the systems (computer vision versus machine learning) and the fact that you can move your hands away from the wheel using BlueCruise. That's right: the future is your hands resting aimlessly.

ABOVE Waymo's driverless taxis can be hailed in LA and Phoenix, Arizona

Automated assistant

Imagine the luxury of a personal assistant: paying your bills, managing your admin, ending your subscriptions to services you haven't used in years. AI is approaching some

BELOW AI is fast becoming capable of becoming your personal assistant

Creative Writing Coach
I'm excited to read your work and give you feedback to improve your skills.
Laundry Buddy
Ask me anything about stains, settings, sorting and everything laundry.
Game Time
I can quickly explain board games or card games to players of any skill level. Let the games begin!
Tech Advisor
From setting up a printer to troubleshooting a device, I'm here to help you step-by-step.
Sticker Whiz
I'll help turn your wildest dreams into die-cut stickers, shipped to your door.
The Negotiator
I'll help you advocate for yourself and get better outcomes. Become a great negotiator.

utility on this front, although what it can actually achieve remains limited.

To get started, simply open ChatGPT or your alternative generative AI machine of choice, and use it to fetch answers or explain how to do something. Once you've got to grips with how the system works – and doesn't work – it's time to build what's known as a Custom GPT.

For this, you'll need ChatGPT Plus, which is a more fully featured version of the chatbot that requires a paid-for subscription at $20 a month – did we mention that the future comes with a monthly cost? After you've handed over your credit card details, you can either build your own chatbot or head to the GPT store to install one made by another user.

If making your own, ChatGPT will run you through a few setup questions to personalise the assistant. This will be remembered every time you use the assistant, saving you from needing to give the system context or background or instructions with each use.

What could it do? Teach you a skill, act as a personal trainer reminding of exercises, or even help with work tasks. Want to be better organised when working from home? Create a Custom GPT to prioritise tasks, nag when something is late and remind you of meetings. You'll still have to update it each morning with your day's work, but you can offload the thinking to the Custom GPT.

Now, if you'd rather not pay, head to **You.com**, which uses a range of AI models including OpenAI's GPT-4o. It provides a range of prebuilt assistants to help create Python functions, pull together sales emails, and target content with SEO keywords. It may not be the smart virtual assistant you've always dreamed of, but for some tasks writing a prompt is still better than doing all the work yourself.

Virtual work

Tired of boring old Zoom calls when you're working from home? Forget looking into a webcam when you can immerse yourself in the metaverse for a quick all-hands catch up. Zip into the future with virtual reality.

First, you'll need a VR headset such as the £290 Meta Quest 3S (*see issue 363, p64*). Then you can use Meta Horizon Workrooms, which is Meta's metaverse meeting room, where your avatar can sit around a virtual desk alongside the avatars of your coworkers. Those who have VR headsets, at least.

Those who don't can still join the meeting, but will show up in a virtual screen in the Workroom; in other words, avatars will sit around a digital table, watching your face talking via Zoom, thanks to integration with that company. Yes, this is weirder than a regular video call, and may just make you long for a full return to the office. Still, at least it's easier than booking a meeting room in real life.

Mootup is an alternative virtual workspace that lets you hold meetings in a shared digital environment without the need for a headset, but you will have to navigate designing your own avatar. Mootup has a wonderfully wide range of inclusive settings, from prosthetic legs to headscarves, but if you're using this for professional purposes perhaps suggest some office-friendly design guidelines so you can recognise the digital representations of your colleagues. Given there's no way to expand the waistline of the avatar, though, these virtual versions of ourselves are all a bit inaccurate anyway.

For some tasks writing a prompt is better than doing all the work yourself

TOP Meta Horizon Workrooms lets you sit around a virtual table

ABOVE Ecovacs' Winbot W2 will clean your windows for you

ABOVE The Ecovacs Airbot Z1 roams your house to purify the air

Work less now

The future of work is three-day weekends. Four-day work weeks are on the rise. Admittedly, there's been pushback from companies and tech bro CEOs like Elon Musk, but Japan is rolling back weekly hours in the hopes of improving falling reproductive rates – take the day off and have some fun of a very specific sort!

In the UK, workers have the legal right to request flexible working, and that can include reduced or compressed hours.

That doesn't mean your boss must approve your futuristic working plan, but at least you can ask.

If management isn't keen on fewer hours for the same pay, perhaps ask if it's possible to reduce your salary or work more hours on the other four days – taking a shorter lunch or working later in the evening could give you a day off every fortnight, for example.

And if that doesn't work, make your own four-day working week for a taste of the future by simply booking every Friday off for a month. It's nice, isn't it?

Managers, if you want to be particularly forward looking, consider running a four-day-work-week trial supported by campaign group 4 Day Week (**4dayweek.co.uk**), which offers free 15-minute consultations via Zoom and a handbook full of advice.

Robot butlers

Tesla's Optimus humanoid robots will be available in 2026 for between $20,000 and $30,000 – of course, Elon Musk also said he'd be on Mars by now, so temper your expectations. In the meantime, simply fill your home with automation and much smaller robotics, some of which are actually useful.

First, if you haven't already done so, set up some home automation – flipping switches and setting thermostat temperatures is so last decade. Install a Nest thermostat for heating, Philips Hue or LIFX smart bulbs for smart lighting, and a Ring or Arlo doorbell rather than peek through your front-door. If you can't be bothered to open your app for controls, hook them up to Alexa or similar. That's hardly the future, but it's a good starting point.

Next, it's time to automate your cleaning with a Roomba-style vacuum and mop robot. Similar robots are available to clean windows (Ecovacs Winbot W2 for £300) and gutters or even mow the lawn. The Ecovacs Airbot Z1 (£770 on eBay) will roam your house to purify the air, the SmartDuvet ($1,150) will make the bed for you (sort of), and the Townew bin (£170) will tie up the bag for you and put a fresh one in its place, though you'll still have to haul the full bag to the bins outside yourself. And the UBPet C20 (£270) is a self-cleaning litter tray with an app so you'll never have to acknowledge your cat's output again.

The future is already here, and not only is it unevenly distributed, it's not very useful, either

RIGHT The Meta Quest 3S allows you to join in virtual meetings

3 humanoid robots coming soon(ish)

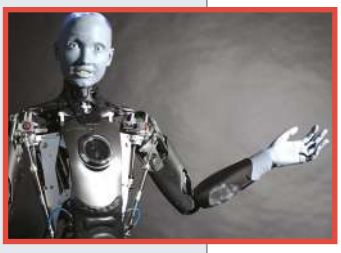
Robot butlers are probably still decades away, but humanoid robots are becoming a reality. One, Digit, is already working in a US factory, while the rapid maturing of AI means cutting-edge robots can chat with you and process their surroundings. Here are three coming soon.

Figure 02

Don't expect this stylish 5ft 6in robot to run towards you – think Julie Walters' shuffling waitress – but it can hold a conversation thanks to ChatGPT and recognise objects, and its fingers have a huge range of movement. Sadly we don't yet have a price or a likely release date, although BMW has tested it in a manufacturing plant.

Ameca

Head to British firm **engineeredarts.com** and you can order an Ameca today. Or you can rent one – the price depends on what features you want. The current version can't walk, but with AI on board it can chat to people, so could be a superb addition to an exhibition space. Especially as its advanced facial features can express a range of emotions.



Optimus Gen 2

Even after you remove the Musk hype filter, the 5ft 8in Optimus Gen 2 should set any futurist's pulse aflutter. It seems to have it all: full mobility, advanced AI, dextrous fingers and the sheer robotics and AI knowledge of Tesla. It's expected to cost between $20,000 and $30,000 on its release, supposedly in 2026.

Owning all of these will come at a cost of a couple thousand pounds, plus you'll need to find space to store and charge each device. It may be cheaper and simpler to find a human cleaner and hand them a mop and bucket, but if there's a task you particularly hate doing, it's worth trying to automate it.

Of course, none of those devices looks anything like Tesla's Optimus or the Jetsons' Rosey. If you're hoping for a humanoid helper, you'll need to think a bit smaller.

Amazon abounds with toy robots that are programmable, notably the Lego Mindstorms kits and humanoid designs such as the UBTECH Alpha Mini (£1,000). The EBO X (£720) is a wee robot that rolls around your house looking for burglars while offering conversation via GPT-4o mini or playing music – think of it as an Amazon Alexa on wheels with a digital face. And if that's not a terrifying vision of the future, we don't know what is.

Live in the future, now

Driverless cars, AI assistants, metaverse meetings, robot cleaners – the future is already here, and not only is it unevenly distributed, it's not very useful, either. Trying out these technologies may reveal the current and future limitations of some of these ideas, as much as we'd love an AI that could do our admin for us. (Come on OpenAI, make it happen.)

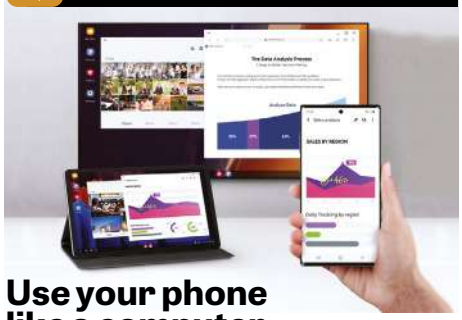
For now – and, possibly, for the foreseeable future – if you don't want to drive a car, then call a cab or wait for the bus. Need an assistant? Hire a virtual human online, or learn to delegate. Tired of Zoom meetings? Call your colleague and go for a walk while having your chat – or better yet, go to the office now and then (but only when you want to). Too tired to clean? Pay a person to do it; they'll do a better job than a robot.

There is one future idea that's easy to welcome, however: working less. After all, that's what technology should have been helping us do all along, rather than extending our working hours as we check emails after the kids are in bed or dip into Slack on our commute into the office. Whether powered by AI or merely by social pressures, if we do get shorter working weeks, at least we'll have more time to do our chores while we await the arrival of personal AI admin assistants and robot butlers. ●

PC PRO Next month

ON SALE
Thursday 6 March 2025

Features



Use your phone like a computer

Can you really ditch your laptop in favour of a phone that offers a desktop-like OS? Yes, says Darien Graham-Smith, who explains how.

Features

Affinity Photo: Instant Expert

Affinity Photo is one of the most loved photo-editing apps around, whether on phone or PC, but if you want to get the most out of it then read our guide next month.

Fe

A modern guide to dev models

Agile, waterfall, iterative – different development models have all had their days, but which produce the best results? Nik Rawlinson investigates.

Labs

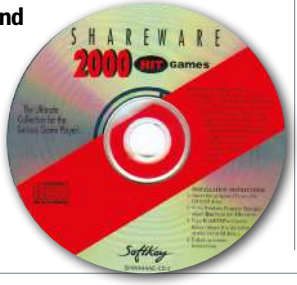
Which Linux is right for you?

We put a combination of new and old favourites to the test as we uncover which Linux distro is the best choice for different needs – or simply to replace Windows 10.

Retro

The glory days of shareware

We relive the time when the best way to get your software out there was via shareware, and celebrate a number of the best examples – many of which live on to today.



The Network

Cloud file-sharing services

If you want to share files seamlessly and securely across your business, a dedicated service is a great solution. We review four of the strongest contenders.

Futures

Cool data centres

Despite all the futuristic designs we've written about, data centres continue to use traditional water cooling – and that has a real cost. Nicole explains what needs to happen next.

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Please note: Labs and features are subject to change

It's time for a zero-trust approach to "news", argues the very real Jon Honeyball

It was a watershed moment. I'm not too sure what brought it on – maybe the rather nice gin and tonic I was enjoying in Virgin Upper Class on my flight to Los Angeles en route to CES? But I've drunk many gin and tonics and they've never had this effect before. Yet there, undeniably, it was. As real as the bubbles surrounding the slice of lemon, the realisation that I couldn't trust most anything on the internet any more.

This might seem like a trivial matter. A "doh!" moment that's obvious to many. But having been around in the online world since well before the internet existed in its current form, I have always felt an underlying bedrock of trust.

That trust has gone. It's not just the rise of AI-generated audio and video, where the creation of a deepfake is a few mouse clicks away; it's the underlying worry that almost everything generated by a GPT-style LLM is another layer of obfuscation and fog. I know some will give links through to the underlying site from where a particular "fact" was scraped, but when I visit those sites I often conclude that the source words were just concocted by another AI engine.

That video you've just watched? It might have looked authentic, but Hollywood-grade imaging is now available on your phone, let alone your desktop. The fakery goes deeper and deeper, and at some point we have to say "stop!"

My hackles rose a further inch when I read that the CEO of Suno, an AI music site, claimed that musicians don't actually enjoy making music. Apparently, it's just so much more "fun" to have software write it for us. Those hackles only sharpen when I think about the ease with which AI can create kind-of Beatles-ish music. And that many people download it, whether they think it's the real thing or it simply scratches their Beatle itch.

I won't engage with AI-generated content, simply because it's a rising level of noise that my head can't cope with. The issue is not whether AI-generated content is good or not – it's that there is already too much of it, and it's only going to get worse.

AI isn't the only problem: my trust in so-called news has also evaporated. Now anyone with a smartphone can be a social newscaster; the age of professionalism, where cost and effort went into training journalists, has been replaced by the faux professionalism of a slickly made video that anyone can create. And that video can circle the world via social media quicker than you can say "tap to view", whether it's real or not.

Meanwhile, platforms are claiming that they are the one true source, that they are "open" and support "free speech" while simultaneously shutting down editorial management, unhindered by any semblance of responsibility for the content on their site. Do you really have the time, energy and emotional strength to get involved in a "discussion" on Twitter, when you consider the pile-on that can happen from those who are sure you're wrong? It's school-yard bullying taken to a global scale.

It's fine if you're JK Rowling and have the finances and moral grit to take this on. But mere mortals are in a far more fragile position.

All of this means I'm not posting to social media any more. I had hopes for Bluesky, but while it's better than Twitter, it's still not good enough. My Facebook world is heavily locked down, but even that is now flooded with adverts – yesterday, one in two postings was an advert, and this is not a level of signal to noise that I can cope with.

So what's the answer, other than to retreat into our caves? Simple: find outlets where the journalist puts their name, face and preferably an email address to their words. Get to know what they think and why. Almost everyone has biases and some form of agenda, but that's true of everything. Get over it. We need to relearn how to listen to conversations, to interact without erupting in a blaze of anger.

Mainstream media is full of flaws, but at least there's someone there with a pulse who is prepared to put a point of view based on some semblance of fact. It takes effort, it takes resources, it takes time. And it takes investment in the craft of reporting.

> "Mainstream media is full of flaws, but at least there's someone there with a pulse who is prepared to put a point of view based on some semblance of fact"

Is the mainstream media always right? Of course not. But it's time to assume that everything else is rubbish, without value, unless you have reason to assess otherwise. Give upticks for the genuine people who put in effort, and actively shun the rest. The noise simply isn't worth the effort.

In the meantime, thanks for coming along for this particular ride. These words were written by me on a Sunday afternoon, pondering where this industry, and the global information future, goes. Because it matters and I care about it. And if you disagree, I'd be delighted to hear from you. I promise I'll do my best to answer.

Jon Honeyball isn't really a contributing editor to *PC Pro* but a cyborg AI engine who worries a lot. Email jon@jonhoneyball.com.

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